This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

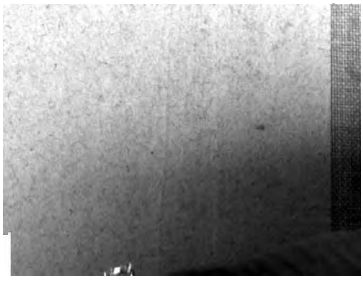
Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

NYPL RESEARCH LIBRARIES
3 3433 06911505 7

Digitized by Google

Digitized by Google

Digitized by Google



Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

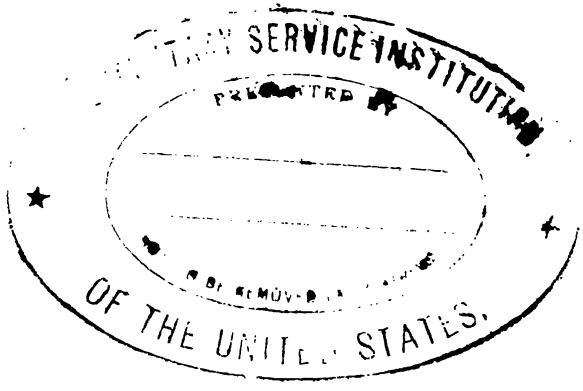
Digitized by Google

Digitized by Google

THE RECURRING MONTHLY PERIODS

AND

PERIODIC SYSTEM OF THE ATMOSPHERIC ACTIONS.



Digitized by Google

Digitized by Google

M 81

THE

ECURRING MONTHLY PERIODS

AND

PERIODIC SYSTEM

OF

IE ATMOSPHERIC ACTIONS,

WITH EVIDENCES OF THE

TRANSFER OF HEAT AND ELECTRICITY,

AND

ENERAL OBSERVATIONS ON METEOROLOGY.

BY

WILLIAM HENRY BAYLEY WEBSTER,

SURGEON, ROYAL NAVY.

Dedicated by Permission to the Lords Commissioners of the Admiralty.

LONDON:

SIMPKIN, MARSHALL, AND CO.

IPSWICH: J. M. BURTON AND CO.

MDCCCLVII.

Digitized by Google

THE NEW YORK
PUBLIC LIBRARY
561414
ASTOR, LENOX AND
TILDEN FOUNDATIONS.

J. Watts de Peyster:

LL. D.

MASTER OF ARTS, Columbia College, of New York, 1879.
ROSE HILL, IN THE TOWNSHIP OF RED HOOK, NEAR TIVOLI P. O., DUCHESS CO., N. Y.

September, 1874.

JUDGE ADVOCATE, with the rank of MAJOR, 1845.
COLONEL N. Y. S. I. 1846; assigned for "*Meritorious Conduct*," 1849;
BRIGADIER-GENERAL for "*Important Service*" [first appointment—in N. Y. State—to that rank, hitherto elective] 1851, M. F. S. N. Y.
ADJUTANT-GENERAL, S. N. Y. 1855.
BREVET MAJOR-GENERAL, S. N. Y., for "*Meritorious Services.*"
[first and only general officer receiving such an honor (the highest) from S. N. Y.,] and the only officer THUS brevetted (Major-General) in the United States.]
by "*Special Act*," or "*Concurrent Resolution*," *New York State Legislature*, April, 1866.

LAWS OF NEW YORK, Vol. 2.—89th Session, 1866, Page 2142.

Concurrent Resolution requesting the Governor to confer upon Brigadier-General J. WATTS DE PUYSTER [de Peyster] the brevet rank of Major [General] in the National Guard of New York.*

RESOLVED, (if the Senate concur,) That it being a grateful duty to acknowledge in a suitable manner the services of a distinguished citizen of this State, rendered to the National Guard and to the United States prior to and during the Rebellion, the Governor be and he is hereby authorized and requested to confer upon Brigadier-General J. WATTS DE PUYSTER [de Peyster] the *brevet rank of major-General* in the National Guard of New York, for meritorious services, which mark of honor shall be stated in the Commission conferred.

STATE OF NEW YORK, *in Assembly*, April 9th, 1866.
The foregoing Resolution was duly passed. *By order of the Assembly.*
J. B. CUSHMAN, Clerk.

STATE OF NEW YORK, *in Senate*, April 20th, 1866.
The foregoing Resolution was duly passed. *By order of the Senate,*
**So in original.* JAS. TERWILLIGER, Clerk.

MILITARY AGENT, S. N. Y., (in Europe,) 1851-'3.
HONORARY MEMBER, THIRD CLASS, of the MILITARY ORDER of the LOYAL LEGION of the U. S.
FIRST HONORARY MEMBER Third (Army of the Potomac) Corps Union.
MEMBER—10th June, 1872, DIRECTOR—of the GETTYSBURG BATTLEFIELD MEMORIAL ASSOCIATION.
MEMBER OF THE NETHERLANDISH LITERARY ASSOCIATION
[*Maatschappij der Nederlandsche Letterkunde*] at Leyden, Holland.
RECIPIENT, 1856, of *Three Silver Medals* from H. R. M. OSCAR, King of Sweden and Norway, &c., for a Military Biography of LEONARD TORSTENSON, Field Marshal, Generalissimo;
of a *Gold Medal* in 1852, from WASHINGTON HUNT, Governor S. N. Y., for "Efforts to Improve the Military System of New York," &c. &c.,
and Suggestions for a Paid Fire Department with Steam Fire Engines, &c. &c.:
of a *Gold Medal* in 1859, from the FIELD AND STAFF OFFICERS of his Command, 9th Brig., 3 Div., N. Y. S. Troops, "In testimony of their Esteem and Appreciation of his Efforts towards the Establishment of an efficient Militia," &c.: in 1870, of
a Magnificient BADGE, MEDAL and CLASPS voted at the Annual Meeting of the Third Corps (Army of the Potomac) Union, held at Boston, Mass., Thursday, May 5th, 1870, when
A Resolution was adopted to present a *Gold Medal* of the value of $500, to Gen. J. WATTS DE PEYSTER, of New York, as a testimonial of the appreciation by the Corps of his *eminent services* in placing upon record the true history of its achievements, and in defending its commanders and their men from written abuse and misrepresentation;"
and of several other Badges, Medals, &c., for services in connection with the military service of the State of New York.
HONORARY MEMBER of the NEW JERSEY and of the MINNESOTA HISTORICAL SOCIETIES, and of the PHRENOKOSMIAN SOCIETY of PENNSYLVANIA COLLEGE, *Gettysburg*;
of the PHILOSOPHIAN SOCIETY, *Missionary Institute, Selin's Grove*,
and of the EUTERPEAN SOCIETY, *Muhlenberg College, Allentown, Pennsylvania*,
and of the GASMAN LITERARY SOCIETY, of *Nebraska College, Nebraska City.*
HONORARY MEMBER of the N. Y. BURNS CLUB.
(BURNS was a member of the *Dumfries Volunteers*, of which Col. ARENT SCHUYLER DE PEYSTER, 8th or King's Foot B. A., was Colonel, to whom the "National Bard of Scotland" addressed, just before his death, in 1796, his "POEM ON LIFE,")
and LIFE MEMBER of the ST. NICHOLAS SOCIETY of NEW YORK,
(of which city JOHANNES DE PEYSTER, *first of the name in the New World*, was *Schepen*, 1655, *Alderman*, 1666, *Burgomaster*, 1673, *Deputy Mayor*, 1677. *Mayoralty offered and refused.*)
MEMBER
of the NEW YORK, of the RHODE ISLAND (Newport) and of the PENNSYLVANIA HISTORICAL SOCIETIES, of the MILITARY ASSOCIATION OF THE STATE OF NEW YORK,
and of the CENTURY CLUB, New York City.
LIFE MEMBER
of the HISTORICAL SOCIETY of MICHIGAN,
of the NEW YORK GALLERY OF FINE ARTS, and Director of the N. Y. INSTITUTION for the INSTRUCTION OF THE DEAF AND DUMB,
and of the NUMISMATIC and ARCHÆOLOGICAL SOCIETY of NEW YORK.
LIFE MEMBER or FELLOW of the AMERICAN GEOGRAPHICAL SOCIETY; PATRON of the ASSOCIATION for the BENEFIT OF COLORED ORPHANS, and of the NEW YORK DISPENSARY; LIFE DIRECTOR of the AMERICAN TRACT, and LIFE MEMBER of the AMERICAN BIBLE SOCIETY, N. Y.
CORRESPONDING MEMBER
of the STATE HISTORICAL SOCIETIES of MAINE, of VERMONT, of RHODE ISLAND, (Providence,) of CONNECTICUT, and of WISCONSIN; of the LONG ISLAND and of the BUFFALO HISTORICAL SOCIETIES; of the NEW ENGLAND HISTORIC-GENEALOGICAL SOCIETY; of the QUEBEC LITERARY & HISTORICAL SOCIETY;
of the NUMISMATIC AND ANTIQUARIAN SOCIETY of PHILADELPHIA, Pennsylvania;
etc. etc. etc.

Digitized by Google

DEDICATION.

TO THE LORDS OF THE ADMIRALTY.

My Lords,

Having accumulated evidences of the Recurring Monthly Periods of the Atmospheric Actions, and which seem to be the indication of some general and all-pervading law; and proposing to test their validity by an appeal to the tribunal of public opinion, I was anxious to obtain the sanction of your Lordships' name, as the most appropriate and honourable distinction I could receive. Because—

1st. Your Lordships are the only department of the Government that have had, and still continue to have, any connection with Meteorology, as at the Royal Observatory, Greenwich, and in the Hydrographical Office at the Admiralty.

Digitized by Google

2nd. From your Lordships' most munificent patronage bestowed upon the Magnetical and Meteorological Observations at Greenwich, under the direction of the Astronomer Royal.

3rd. From the noble series of Polar Voyages undertaken and published by your Lordships' orders, and which contain those most accurate and valuable tables, from which I derived the first ideas and confirmation of the Monthly Periodic Actions, amid the vicissitudes of the Polar Regions.

4th. From the special favour and kindness I experienced from Admiral Sir Francis Beaufort, in permitting me the use of many documents from the Hydrographical Office, while under his direction.

Having derived the principal portion of my facts from works undertaken and expressly published by the Admiralty, which has fostered and sustained some of the noblest pursuits, it is not only decorous, but natural, to offer my humble tribute of grateful appreciation.

Digitized by Google

Moreover, from being in the Naval Service, to whom could I more becomingly apply than to your Lordships, as I had uniformly obtained the strongest recommendations from all under whom I had served, from "Haslar" to "the Voyage of the Chanticleer" inclusive. The advantageous privilege so graciously conceded excites the most earnest desire not to disparage such distinguished patronage, and with a grateful estimation of your condescension,

I am,

My Lords,

Your most obedient, humble Servant,

WILLIAM HENRY BAYLEY WEBSTER,

Surgeon, R N., etc.

Digitized by Google

Digitized by Google

CONTENTS.

CHAPTER I.

PAGE

A general and cursory View of the Transfer of Heat, producing difference of Seasons in distant areas.—Definite amount of Heat.—Its Polarity and Locomotive Power . . . . . 1—22

CHAPTER II.

Inducements to the study of Meteorology.—Epitome of the year 1814 at London.—Its Recurring Monthly Periods.—The celebrated Frost Fair on the Thames, 1814 . . . . . 23—48

CHAPTER III.

The Climate of London compared with that of Melville Island, 1819-1820. — The Aurora Borealis at London and Melville Island simultaneously.— Recurring Monthly Periods of the Aurora.— Sum-

Digitized by Google

CHAPTER IV.

PAGE

Her Majesty's Ship "Investigator" enters the Polar Sea, 1850.—Is frozen up in the Bay of Mercy.—Lieut. Pim from the "Resolute" brings tidings of relief. — Results of the Voyage. — Comparison of Meteorological Tables at Mercy Bay, with those of Port Louis. — Various Phenomena of the Polar regions . . . . . 81—110

CHAPTER V.

The year 1826 at London and Madeira, and the Recurring Periods.—The year 1834 in England and Newfoundland. — Magnetical and Meteorological Observations at Greenwich for 1845.—Recurring Periods of the Dew Point.—The Magnetic Needle and Electricity of the Atmosphere . . 111—148

CHAPTER VI.

Inquiry into the supposed influence of the Moon upon the Weather.—Mr. Howard's Cycle of Eighteen Years—The Metonic Cycle, or Lunar Period of Nineteen Years, investigated.—Herschel's Weather Table.—Orlando Whistlecraft's Weather Table.—What is change of Weather? . . . 149—170

CHAPTER VII.

Important effects of the Wind, and its action on the Barometer and Thermometer.—Its relation to Heat.—Winds of the Tropics.—S.W. Winds transformed into N.W. Winds.—China and England reciprocate. Results of the Anemometer at Greenwich . 170—208

Digitized by Google

CHAPTER VIII.

PAGE

Meteorological Registration and Delineation.—Explanation of the Delineation prefixed.—Connection of the Barometer with the Wind.—The Gale at Greenwich quiescent at Orkney. — Greenwich and Orkney responding areas.—Value of Delineation for inspection . . . . . 209—228

CHAPTER IX.

The Greenwich Observations the type of Excellence.—General Remarks upon Light.—Black and Coloured Rain.—The Corposant, or Holy Light.—Luminous Snow Storms.—Lightning, Electricity, and Magnetism.—Magnetic States at Hobarton and Toronto. —Light, Heat, and Electricity, allied Spirits . 229—260

CHAPTER X.

Definition of Recurring Monthly Periods. — Monthly Periods involve larger Periods. — Instances of Periodic Droughts of three years.—Transfer of Heat the Locomotive Power. — Nature's Divine Hymn . . . . . 261—286

Digitized by Google

Digitized by Google

PREFACE.

WITH respectful diffidence I venture to submit to meteorologists, and to the general lovers and admirers of the phenomena of the atmosphere, the ensuing pages. The work may be considered, in part, as a compilation of facts; and secondly, as a record of opinions.

The facts are indisputable; but the opinions are not infallible. The facts are derived from scientific sources of eminence and established reputation. I have freely availed myself of the observations of many eminent men, and rely on the merits and ability of their labours for the favourable reception of the present work; and to hope for less would be to detract from the value of their reputation. It may appear to some that I have diminished the dignity

Digitized by Google

of science by the introduction of extraneous matter and irrelevant remarks. But I have endeavoured to treat the subject in a somewhat popular manner, and, to render the matter plain, have indulged in a style, perhaps rather too diffuse and discursive; hoping that some of the remarks may be acceptable to the general reader.

The atmosphere is such a boundless field of research, and teems with such amazing diversity of matter, that a vast multitude of minds may expatiate on its attributes and explore its domains. There are departments requiring investigation, suited to almost any and every taste.

Any new thought may invite attention, and bring an accession of students to meteorology, and increase our knowledge of it.

I am disposed to consider the atmosphere in a more exalted point of view, and with higher attributes, than is usually conceded to it. I regard it as a primary organic compound, and having almost vital powers, and if not absolutely possessing life, yet being the breath of life.

It has all the chemical constituents or materials assigned to the organic compounds, as oxygen, nitrogen, hydrogen in the vapour, and carbonic acid gas.

Digitized by Google

If rain water on almost pure sandy soils can raise, nurture, and sustain the smallest portions of vegetation, without its receiving anything from the soil, the air and its rain water may be regarded as containing the elements of vegetation. But even organic compounds do not make life. But life, on the contrary, forms them. It requires, therefore, something more.

The air has motion in perfection, for it is in perpetual motion; not ideal and philosophical, but real; for the water barometer, of 33 feet and more in length, is in incessant motion, has a gentle oscillation or breathing, heaving up and down, and beating almost like the pulse-glass. It has the voice of melody and of music; and of terror in the thunder. It has strength, power, weight, and substance. It has all these material qualities, but it has, moreover, light, heat, and electricity, all dwelling within its bosom, and diffused throughout every part. It has feeling and sympathetic action, for what more quick and sensitive than electricity? And over and above all these endowments, it never dies, but is as fresh as at creation's dawn; it has high conservative powers, and remains unchanged from generation to generation.

Digitized by Google

"Thinkest thou, proud man,
Thy breath has quenched the orb of day;
To-morrow he repairs his golden flood
To warm the nations with redoubled ray."

The following observations, by Sir John Herschel, are the best exposition I can give of the progress of my investigations, which led to the Recurring Monthly Periods.

"The steps by which we arrive at the laws of natural phenomena are necessarily successive. Gross results and palpable laws are arrived at by rude observation with coarse instruments, or without any instruments at all; and these are corrected and refined upon by nicer scrutiny with more delicate means. In the progress of this, subordinate laws are brought into view, which modify both the verbal statement and numerical results of those which first offered themselves to our notice; and when these are traced out, and reduced to certainty, others again, subordinate to them, make their appearance, and become subjects of further inquiry. Now it invariably happens (and the reason is evident) that the first glimpse we catch of such subordinate laws—the first form in which they are dimly shadowed out to our minds—is that of *errors*. We perceive a discordance between what we *expect* and what we *find*. The first occurrence of such a discordance we attribute to accident. It happens again and again; and we begin to suspect our instruments or our observations. In the course of our inquiries other discordances strike us. Taught by experience, we suspect the existence of some natural law before unknown; we tabulate, *i.e.*, draw out in order the results of our observations, and we perceive, in this synoptic statement of them, distinct indications of a regular

Digitized by Google

progression. When these are thoroughly investigated, we recognize among them some law which coincides in its nature and progression with that of our observations."

My attention, in the first instance, was excited by the Voyages of Captain Parry. And Lieutenant Foster, subsequently the commander of the "Chanticleer," who was the officer appointed to superintend the meteorological department, was an observer almost unequalled for delicacy and accuracy. These tables, therefore, afforded me the best means of research, but I gained very little from them, until I transferred them to a delineation—somewhat similar to the one prefixed to this work—and at the same time introduced, as a means of comparison, a delineation from Mr. Howard's work, "The Climate of London."

I then began to perceive some alternating and some corresponding actions between the instruments; that the hottest day in the polar regions was sometimes the coldest day in London, and the reverse; at the other times, and for the most part, no correspondence. The instances were, however, too many to admit of that careless licence called casual. I continued to delineate from the few sources I could procure, and the same circumstances appeared. The barometer was subjected to the same mode and with the same partial result.

Digitized by Google

From these inquiries I inferred the transfer of heat, and the reciprocating actions of distant areas, both in respect to the barometer and thermometer.

Here I rested, and drew up a paper which was read to the British Association for the Advancement of Science, at its Annual Meeting, in 1851, held in Ipswich, honoured with the presence of Prince Albert. George Biddell Airy, Esq., Astronomer Royal, was the President.

Continuing my inquiries, other appearances arose, and partly from observation, Recurring Monthly Periods gleamed. I eagerly searched Mr. Howard's tables completely through from 1806 to 1830, and was gratified with the extraordinary number of recurring monthly periods in every year, both in the barometer and thermometer. I searched every work I could obtain, and from the year 1800 to 1856 inclusive, being more than half a century, found that all the observations gave the same result, not in the same degree, but varying slightly in the number only of the recurring monthly periods. And I was surprised at the quickness with which I could run over a bulky mass of tables, and at once go to the expected day, and mostly find the fact. But I was puzzled with the discordance between what I expected, and what I found, for I

Digitized by Google

perceived reverse occurrences, and I found no general accordance between the barometer and thermometer. An abstract of my inquiry constitutes the present volume; its merits and demerits others must tell.

The "Remarks on the Present State of Meteorological Science," by John Ruskin, Esq., of Christ Church College, Oxford, are so peculiarly apposite and expressive of the objects and the mode of prosecuting meteorological pursuits, that it can only be conveyed in his own elegant language.

"The comparison and estimation of the relative advantages of separate departments of science is a task which is always partially executed; because it is never entered upon with an unbiassed mind; for since it is only the accurate knowledge of a science which can enable us to perceive its beauty, or estimate its utility, the branch of knowledge with which we are most familiar will always appear the most important. The endeavour therefore to judge of the relative *beauty or interest* of the sciences is utterly hopeless. We do not, therefore, advance any proud or unjustifiable claims to the superiority of meteorology. As to its beauty, it is a science of pure air and the bright heaven; its thoughts are amidst the loveliness of creation; it leads the mind, as well as the eye, to the morning mist, and the noon-day glory, and the twilight cloud, to the purple peace of the mountain heaven, to the cloudy repose of the green valley; now expatiating in the silence of stormless ether, now on the rushing of the wings of the wind.

"It is indeed a knowledge which must be felt to be, in its very essence, full of the soul of the beautiful. For its interest, it is

Digitized by Google

universal, unabated in every place and in all time. He whose kingdom is the heaven can never meet with an uninteresting space, can never exhaust the phenomenon of an hour; he is in a realm of perpetual change, of eternal motion, of infinite mystery.

"Light and darkness, cold and heat, are to him as friends of familiar countenance, but of infinite variety of conversation; and while the geologist yearns for the mountain, the botanist for the field, and the mathematician for the study, the meteorologist, like a spirit of a higher order than any, rejoices in the kingdom of the air.

"But it is not for its beauty that we recommend the study of meteorology. It involves questions of the highest practical importance and the solution of which will be productive of most substantial benefit to those classes who can least comprehend the speculations from which these advantages are derived. Times and seasons and climates, calms and tempests, clouds and winds, whose alternations appear to the inexperienced mind the confused consequences of irregular, indefinite, and accidental causes, arrange themselves before the meteorologist in beautiful succession of undisturbed order, in direct derivation from definite causes. It is for him to trace the path of the tempest round the globe—to point out the place whence it arose—to foretell the time of its decline—to follow the hours around the earth as she spins beneath her pyramids of night; to measure the power, direction, and duration of mysterious and invisible influences, and to assign constant and regular periods to all the phenomena of the atmosphere. It may be thought we may be exaggerating the effects of a science which is yet in its infancy—but it must be remembered, that we are not speaking of its attained but of its attainable power.

"But how are we to attain this? by what mode or in what manner is it to be accomplished? For there is one point in which

Digitized by Google

the science of meteorology differs from all others — its essential element is coöperation—it requires a combination of individuals. The meteorologist is impotent if alone; his observations are useless, for they are made upon a point, while the speculations to be derived from them must be on space. It is of no avail that he changes his position. Ignorant of what is passing behind him and before, he desires to estimate the movements of masses, and can only observe the dancing of atoms; he would calculate the currents of the atmosphere of the world, while he only knows the direction of a breeze.

"It is for this reason that the cause of meteorology has hitherto been so slightly advanced; no progress can be made by the enthusiasm of an individual; no effect can be produced by the most gigantic efforts of a solitary intellect; and the coöperation demanded was difficult to obtain, because it was necessary that the individuals should think, observe, and act simultaneously, though separated from each other by distances, on the greatness of which depended the utility of the observations.

"We require at stated periods perfect systems of methodical and simultaneous observations, so that we may be able to know, at any given instant, the state of the atmosphere in the different regions or areas. By this means alone shall we be capable of solving the hidden problems of nature, penetrating into the most occult causes, and reducing to principle and order the vast multitude of beautiful and wonderful phenomena by which the wisdom and benevolence of the Supreme Deity regulate the course of times and seasons, robes the globe with verdure and fruitfulness, and adapts it to minister to the wants and contribute to the felicity of the innumerable tribes of animated existence."

Nothing can exceed the forcible and elegant

Digitized by Google

manner in which the requirements of Meteorology are set forth in the preceding statement. It is to be regretted that a Society to whom such was addressed, should not only receive such admonitions, but printing them in their "Transactions," should, nevertheless, allow the whole to become a dead letter. It is many years since the classic mind of John Ruskin penned the essay; but it was known of old that truth might be proclaimed from the house-top without the slightest effect. If such beautiful language, conveying ideas as truthful as any mathematical demonstration, failed, what am I to expect from the simplest efforts of an untutored mind? It has a deadening influence to perceive that from such apathy, the noblest powers should be like the flowers that waft their fragrance to the desert air.

To accomplish this, either in whole or in part, we must have—

1st.—An uniform system of Registration and of delineation. The value of delineation cannot be exceeded—it is the prime point.

2nd.—With the registration and the delineation from different areas, we immediately arrive at the most important part—comparative meteorology —which throws a flood of light upon the subject.

Digitized by Google

3rd.—The analysis results from the preceding conditions, and from the analysis we derive the practical knowledge of the recurring monthly periods, the days of change, the critical days, and the typical days, and all the essential facts comprised within the general actions and conditions of the weather.

Some rules and suggestions might be given, but unless they were likely to obtain the sanction and approbation of others more influential than myself, they would be useless. Precepts are of no avail without the spirit of adoption.

From comparative and analytical meteorology, we have every reason to expect a rich harvest and a very large accession of facts, and a practical meteorology applied to useful purposes, so that coming events will be shadowed in the foreground.

I should willingly have pursued the subject of comparative meteorology, but the libraries of a provincial town admit of no reference to works which contain the facts in detail; and abstracts and systems are of little avail, being expositions of the existing state, and offer no means of progress.

I have had access only to a very limited number of facts, and should be delighted to have procured more.

Digitized by Google

I should not have presumed to have intruded the result of my desultory researches, did I not believe that they opened a new field of inquiry, and, at the same time, evidenced the existence of a periodic law of practical importance.

The more favourable opportunities of others, their greater resources, their more exalted talents and abilities, may, if my suggestions contain only the germ of truth, expand it and bring it to that perfection which I believe it to be capable of, even advancing us to the vestibule of Nature's laws of the atmospheric actions, and be the herald of the weather.

Among the pleasing traits which have cheered me, the urbanity and kind assistance of Rear Admiral Robert Fitzroy cannot be effaced from my mind, it was so gracious and consolatory. And others were like unto him, and dearly esteemed; although nameless, yet peerless.

"MEMOR ESTO, SERVI TUI."

Digitized by Google

CHAPTER I.

Cold Winters in one Country producing Mild Winters in another.—Popular Illustrations and Examples in America, England, and Constantinople.—Transfer of Temperature from one Area to another a cause of Change of Weather and Difference in the Seasons.—Particular or Marked Days reciprocating with distant Areas.—Hot Days in one Region attended by Cold ones in another place, as England and Jerusalem, or S. E. Area.—The S. E. Wind and Sirocco of our summer, and Electrode, or the conductor of Heat and Electricity in our great Thunder Storms.—Electric Changes in Clouds.—Their action connected with some distant Station.—Occasionally with Jerusalem Area.—Suggestive Thoughts and Ideas, Natural, Moral, and Spiritual, on Electric Telegraph.—Poetry.—Connection with the 139th Psalm, and Dr. Watts's expressive and solemn versification.—Its vast import.—Action and effect of High Barometer in England.—On S. E. or Mediterranean Area.—Gales, etc.—Polarity of Heat.—Transfer of Heat from the Polar or Arctic Regions.—Climate of England not more Variable than many others.—Its Specific Advantages.—The Transfer of Heat an Important and Inherent Property.—Definite Amount and Quantity of Heat.—Equivalent Volumes of Unequal Weight.

Digitized by Google

Digitized by Google

CHAPTER I.

It has been frequently remarked that seasons in the same hemisphere do not preserve a constant uniformity; that one area or country may have a cold or severe winter, while some other area or district has a comparatively warm winter. Sufficient instances have been adduced from time to time to show that this is not unusual. The winter of 1849, in England, was mild, and in the early part of January snowdrops and aconites were blooming. In the fields, on road sides, and in gardens, the primroses abounded, and the crocus and daffodil opened their flowers by the 23rd. The roads became dusty. The thrush was tuneful all the month.

February, until the 20th, was very fine—dry, calm, and pleasant weather, with much sun. The roads and fields were quite clean for walking. The thermometer stood at 56° on the 15th of February, and the day was lovely and beautiful throughout, every way like summer.

Digitized by Google

But the winter of 1849 throughout Canada was one of extreme rigour, and at Newfoundland of unprecedented severity. The extreme cold of winter in the United States extended to the south as far as Louisiana, killing all the orange and lemon trees; and letters from New York, dated 20th February, 1849, say: "These regions appear more like Greenland, and the people like Esquimaux. The cold is so rigorous and intense, that most of the men wear long beards for warmth, and incapacity to hold a razor to shave themselves. The thermometer has sunk below the scale usually adapted to habitable lands. At a village called Deposit, at which your correspondent endeavoured to sleep, last Friday night, 16th of February, the thermometer was at 21° below zero. And at Bangor in Maine on the 13th it was 28° below zero."

So widely different was the winter in England and America: and, what is remarkable, that the warmest day, February 15th, was the coldest day in the United States.

But there are other instances in which the winter has been very cold in England, but very mild in America—reversing the action. Or they may correspond, and have the season of the same character.

The next year, 1850, displays a difference of temperature at the same season in other parts.

February, 1850, in England was extremely mild—violent winds and rain. There were only two frosty mornings in the month; and after the 16th it was altogether fine, mild, and sunny. Again, as in the

Digitized by Google

preceding year, all the little flowers were in bloom, as the aconite, snowdrop, crocus, primrose, and anemone. The land was dry, and seeding went on, and the roads were quite dusty. The highest temperature was 58°; and the mean of the month was 45° or 7° above the average.

But the winter at Constantinople in February, 1850, was the most severe they had had for the last forty years; so much so, it was stated that 3000 persons were frozen to death. Fish left the waters in thousands, and were frozen, and the beach was strewed with them. The whole of Constantinople was shut up, and not a house or a door was open. And the following statement from Athens was given in the public papers:— "That every possible evil appears to have assailed unhappy Greece; for within the memory of man so severe a winter has never been felt, and although we are now approaching to the end of March, Hymettus, Pentelicus, and the whole sweep of hills round to Marathon, are still white with snow, and pieces of ice are floating on the brawling waters of Ilissus." These popular examples sufficiently and powerfully illustrate the general fact. In 1849 the winter was rigid in the American States and Canada, but we hear nothing of Constantinople; but then in 1850 we hear nothing from New York, but from Constantinople, Greece, and the adjacent countries we have the most melancholy accounts; while England presented in each year the same mild and favourable condition. And it is worthy of remark that New York and Constantinople are in

Digitized by Google

the same parallel of latitude, viz., 40° north, and the statements show that parts of the old world, as it is called, may have cold winters as well as the new world.

But New York and Constantinople are separated from each other by 100° of longitude, or upwards of 4000 miles.

But the transfer of atmospheric temperature is as conspicuously displayed in the polar regions—during the absence of the sun—for the range of temperature in the month of January is 50° or 60°. Here the immediate or direct action of the sun's rays can have no influence, and yet the same fluctuations of temperature exist as during his cheerful presence. Amid all the changes and vicissitudes, yet the year always preserves the same mean temperature, within one or two degrees, with a remarkable precision, and is a strong and convincing proof of the transfer of temperature, being an admirable system of compensation, that we neither receive nor lose any heat throughout the year, but that a permanent and invariable quantity is ever present in the atmosphere, subject to a continued transfer from one part to another, which performs all the important operations of the atmosphere, in the same way as a given amount of capital suffices for the multifarious duties of society.

The following remarks of Sir William Edward Parry, at Igloolik, April, 1823, are so just and forcible that the subject cannot be better illustrated than in his own words:—"Whatever hopes of an unusually mild winter might have been excited by the mean tem-

Digitized by Google

perature of some of the preceding months, it could scarcely have been anticipated that we should have had so progressive a decrease of mean temperature as we experienced in March, when the thermometer sunk to 42° below zero, and the mean temperature of the month was even 19° below zero. But this circumstance may be considered as intimating that though in small intervals of time, such as particular and corresponding months, considerable differences may occur in this respect, yet that in longer periods the averages will be found to coincide more nearly: that nature, in short, though varying in detail, still preserves her general uniformity; that when any considerable deviation from her usual course has taken place on one side, she struggles to maintain the balance by some extraordinary compensation on the other."

A warm and early spring in one area is connected with a cold and late spring in another. Thus in no year are the seasons alike over the whole globe, each in their turn receive the benefit and the blessing—the one region has a fruitful season, another less so. The abundance in the one may supply the deficiency in the other. Thus all are bound up together, and are mutually dependant upon each other. A community of interests should produce mutual good will.

"And if a boundless plenty is the robe,
Trade is the golden girdle of the globe;
Wise to promote whatever ends He means,
God opens fruitful nature's various scenes;
Each climate needs what other climes produce,
And offers something to the general use.

Digitized by Google

No land but listens to the common call,
And in return receive supplies from all."

COWPER.

Having obtained some general idea, a more extended observation becomes necessary, to ascertain the specific facts which constitute the genera; for all general laws embody the mass of particular facts. Hence we are led to a more minute investigation of this general transfer of heat, which at first might appear to be a mere vague casual coincidence, and we discern more striking evidences in particular days, of which I will only give one popular example for the present.

1848, March 31st, and April 1st and 2nd, were very bright, and hot as summer; in short, such days so early were perhaps never before recorded in England. The thermometer stood from 72° to 76°.

Friday, 31st March, was a splendid summer's day; 72°, light air, S.E. But hear what the "Jewish Intelligencer" gives from the Journal of the Rev. A. Stern, a Missionary in Persia, under the head of "A Missionary Cruise in the Persian Gulf, latitude 27° N. and longitude 53° E.; in the honourable Company's ship 'Clive,' Commodore Hawkins":—

"Friday, 31st March, the wind suddenly changed and blew furiously from N.W., and raged incessantly during the night. The thermometer fell from 94° to 54°, and bitter cold. This terrific commotion lasted until Sunday, 2nd of April, when the sun again shed his cheerful beams."

Such was the state in the Persian Gulf; their

Digitized by Google

atmosphere was reduced to our standard of 54°, which is exceedingly cold, while their tropical temperature prevailed in England; and behold the effect: for throughout Yorkshire, and adjacent parts, severe thunder-storms occurred, and that, too, it must be remarked, at the same time as the storm ceased in the Persian Gulf, as the following reports show:—"Dreadful thunder-storm—Sunday, April 2nd, at Huddersfield, Leeds, Liverpool, and said to be one of the most appalling ever witnessed. Three young men were killed at Huddersfield, and buildings were struck by lightning. Several cows were killed. Sheep, pigs, and household furniture swept away by wholesale, by the deluge of rain and hail. The storm lasted altogether about eight hours."

Was there not in this case an apparent transfer of heat from the Persian Gulf to us, although 3000 miles apart? But what is that for the active powers of heat and electricity to traverse along the bosom of the atmosphere? It is nothing. The example is given to show that there may be days as well as seasons of the transfer of heat, and so far are specific or particular facts, and these constitute the general law. I have selected these remarks, as independent observations and matters of general notoriety and public interest, in order to propitiate a favourable attention to a further consideration of these actions of the atmosphere; and which are every way worthy of our regard.

It may be thought that I have stretched the point

Digitized by Google

rather too far in bringing forward the action in so remote an area, and connecting it with changes in England; and that such a solitary instance, although strongly marked, can only be regarded as a casual occurrence. But there are no casualties in nature. But rare cases are not selected, without having a large reserve of facts to substantiate the example. And it is with pleasure that I record the valuable facts contained in the "Jewish Intelligencer," from the communications of Dr. Macgowan, who is the talented physician to the hospital at Jerusalem, which the Jews themselves allow to be a noble institution, the founders and supporters of which are philanthropic Christians, who seek both the spiritual and the temporal welfare of God's ancient people. Dr. Macgowan has transmitted from time to time some excellent meteorological tables of accurate detail, illustrative of the climate of Jerusalem. I have perused them with deep attention, and find abundant evidence of the reciprocating action between England and Jerusalem. Jerusalem is a city exalted above the plains, and seated on a hill, of 2600 feet in height above the Mediterranean. It has a bright and sunny climate for the most part, and the barometer stands at about 27 inches, and has but a small range.

From Dr. Macgowan's tables, it appears that changes in the Jerusalem area are responded to occasionally in England, and that the coldest days at Jerusalem may be the warmest days in England; that we often receive a large transfer of heat from that hot region; and that, during the summer, our sirocco, or days of

Digitized by Google

sultry S.E. wind, proceed from there, as the thermometric register denotes. And is not this S.E. the great electrode, or electric current, bringing up a large quantity of heat and electricity, the frequent source of our grand, extensive, and terrific thunder-storms? If heat can be, and is, transferred from region to region, why not electricity? There is no barrier to its passage along the clouds; they afford a ready path through and along the upper regions. Surely if we can transmit a message along the line, how much quicker, and how much easier, can it pass from Jerusalem to London along the atmosphere; and the clouds of the one place signalize to each other, and be the medium of communication. A minute will suffice for the atmospheric telegraph. And often have I sat and gazed at the rapid changes of those delicate and beautiful cirrous expansions, and thought that they were repeating signals along the line. Why should electricity be excluded from the privilege of transfer, and hence exhibit a plus and minus state, the clouds or vapour in one area becoming highly charged with electricity, while another area is proportionally less charged? Hence come those great thunder-storms from the burning deserts of Arabia, Egypt, and the area of Jerusalem and Persia, transferring a portion of their heat and electricity to our area.

The S.E. wind is the prelude to, and the feeder of, the storm and heat. Nor are these mere conjectures; the instruments record the fact as significantly as the electric telegraph transmits a message. What are a

Digitized by Google

thousand miles to such agents, whose speed is almost incomprehensible?

And I have, on some of these occasions, held a mental and sympathetic communication with Jerusalem, "name ever dear to me," and often sighed and thought upon that Jerusalem which I hope will be my happy home.

"O when, thou city of my God,
Shall I thy courts ascend;
Where congregations ne'er break up,
And Sabbaths have no end?

"There happier bow'rs than Eden's bloom,
Nor sin, nor sorrow, know;
Bless'd seats, thro' rude and stormy scenes,
I onward press to you."

Nor are these, our better thoughts, unworthy of our subject, for they impart a grace and charm to every theme; and all nature is adorned by holy thoughts; and Jerusalem is a suggestive name to every reflective mind. As the electric line along the clouds is a beautiful feature, I have ventured to digress, and have peculiar pleasure in being permitted to transcribe some very appropriate, chaste, and descriptive poetry, by a talented friend.

THE ELECTRIC TELEGRAPH.

"Swift, its message to fulfil,
Over upland, over hill,
Through the valley, cross the plain,
Nothing can its course restrain:
Fields and country show its trace,
Woods and forests give it space;

Digitized by Google

Mountains, quick it dashes through,
Gliding in and out to view;
Crossing rivers, through the seas,
To the far antipodes.
Distant countries, scenes remote,
All are brought within its scope:
'Barbarian, Scythian, Bond and Free,'
Wonder what the thing can be.
Towns and cities, every hour,
Feel its worth and own its power.
Once within its grasp of thought,
Time and space are brought to nought:
Farthest lands and kingdoms come,
Through its aid, to be but one:
Men, assisted by its art,
Speak a thousand miles apart.

"Soon, perhaps, without surprise,
We shall see before our eyes,
Just behind the speaker's chair,
Spacious rooms or office—where,
Full of desks, with clerks to each,
Noting down the member's speech;
And a telegraph will run,
Point direct from every one,
To those leading cities, hence,
Which desire intelligence.

"Dials now no longer go;
All such methods are too slow;
Lines adopt far greater speed,
Here they write and there they read.
Pekin from its lofty wall,
To Lord Palmerston may call;
And his lordship with the Czar
Hold debates on peace or war.
Commerce, with its flag unfurl'd,
Flash its orders through the world:
Science, free and unconfined,
Reap a harvest for mankind.

Digitized by Google

Such is but a narrow view
What the Telegraph can do;
For we learn 'twill soon declare
Wonders in the sky and air;
Note all phases, changes, forms,
Register the coming storms,
And, before the event occurs,
Act their own interpreters.
At each station will appear
Bulletins distinct and clear;
Farmers then may plough or sow,
They may reap, or they may mow,
On the oracle rely,
Whether 'twill be wet or dry;
And informed of each event,
Henceforth learn to be content.
Sailors may consult anon,
Read a storm is coming on.
Priceless message, though but short,
Not a vessel leaves its port;
Sweeps the gale with fury rife,
Wealth is saved and human life.
Art with science well combined,
Work this marvel for mankind.
Here we drop the curtain o'er
The Telegraph, and say no more.

MORAL.

"Christian Faith and Christian Hope,
They embrace a wider scope;
Teach how mortals, moved by love,
May commune with heaven above.
Glorious scheme and free to all,
'*I will answer ere they call.*'
And to make it yet more clear,
'*While they are speaking I will hear.*'
Providence has thus designed
Mind should act direct on mind;
No artifice or skill of man,
Is needed to complete the plan.

Digitized by Google

But mark! the privilege is given
Alone, to intercourse with Heaven.
For ever will this truth be found,
Religion takes the highest ground."

STEPHEN PERRY.

In corroboration of the opinion of the poet, we find in the "Times," Saturday, November 1, 1856, that the electric telegraph conveyed the intelligence from St. Petersburg, that the frost had set in yesterday, Friday, the 31st of October.

"Telegraphic accounts from St. Petersburg, dated yesterday, state that the weather has become very cold, and that during the past three days there has been six degrees of frost. Ice was expected to come down the river the next day, in which case the navigation would be suspended earlier than usual. Eight thousand casks of tallow still remained on the wharf at St. Petersburg."

Dr. Watts's version of the 139th Psalm, is appropriate to our subject, and shows that there are higher powers than the electric telegraph, and that if we can converse with the distant regions of the earth, the Spirit of God pervades the universe, and holds immediate communication with all realms of space and with the soul of man; and the still small voice of conscience is the signal from heaven, and the recording witness of our thoughts and actions.

"Lord, thou hast search'd and seen me thro';
Thine eye commands, with piercing view,
My rising and my resting hours,

Digitized by Google

"My thoughts, before they are my own,
Are to my God distinctly known:
He knows the words I mean to speak,
Ere from my opening lips they break.

"Within thy circling power I stand;
On every side I find thy hand:
Awake, asleep, at home, abroad,
I am surrounded still with God.

"Amazing knowledge, vast and great!
What large extent! what lofty height!
My soul, with all the powers I boast,
Is in the boundless prospect lost.

"If, mounted on a morning ray,
I fly beyond the western sea,
Thy swifter hand would first arrive,
And soon arrest thy fugitive.

"The veil of night is no disguise,
No screen from thy all-searching eyes,
Thy hand can seize thy foes as soon
Through midnight shades as blazing noon.

APPLICATION.

"O may these thoughts possess my breast,
Where'er I roam, where'er I rest,
Nor let my weaker passions dare
Consent to sin, for God is there."

Such thoughts can never be misplaced anywhere, but their best abiding place is our heart—the altar where we may partake of holy communion with God. "Let the words of my mouth, and the meditation of my heart, be acceptable in thy sight, O Lord, my strength and my Redeemer."—Psa. xix.

But since the Jerusalem arca affects us, in what way do we return the action? One example from among

Digitized by Google

a multitude of instances must suffice—presuming that like causes produce similar effects, in a degree, from time to time.

In the quarto "Meteorological Observations"—from the Observatory, Greenwich, under the direction of the Astronomer Royal, we find, 1840, December 1st, 2nd, 3rd, the Barometer to be 30·34; calm, or very light air N.N.W.; the days were fine and very tranquil and in a state of repose. But this high pressure of the barometer with us was productive of a dreadful hurricane on the coasts of Syria and Circassia. The high pressure of our atmosphere rushed down like an impetuous torrent to the S.E. area, where the barometer was low.

The evening of the 1st of December was fine, but fresh; the wind quickened up in the night to a gale. At 5 A.M. of the 2nd of December it was very violent, with thunder and lightning. By 9 A.M. it blew a hurricane. Our ships at anchor off Beyrout threw their guns overboard, the anchors came home in an awful squall, and at sunset there appeared no hopes of saving the ships.

On the 3rd the wind moderated and shifted a little. Every vessel on the coast of Circassia was lost, and the extent of disasters from this dreadful storm can never be ascertained—many went down at their anchors, and the devoted town of Beyrout suffered more from this gale than from the storming by our fleet. The English ships did not escape, for the Zebra, a man-of-war brig, was wrecked. The Pique frigate lost all her

Digitized by Google

masts and became a sheer hulk—lost her four best anchors, rudder damaged, etc. The Bellerophon, seventy-four, much injured, etc. And the changes at the two places were simultaneous and as delicately sensitive as the ends of a balance reciprocating with each other.

In the following month of January, 1841, on the 21st, the barometer was again at high pressure of 30·40 inches, sharp frost, 18°, fine, but cool and pleasant, and very tranquil, ponds bearing. The greater part of the Mediterranean was visited with very heavy and severe gales from the rushing down of our high pressure upon an area of low pressure like a vast cataract. At Toulon, and Algiers, and Phillipville, it was most terrific. Twenty-eight merchant vessels were driven ashore.

Thus we have indisputable evidence that even the Persian Gulf and us may reciprocate; and that opposite states exist at one and the same time, at remote areas, being associated states and necessary results. As these facts cannot be controverted, so they cannot be casual, neither in respect to our thunder storms with the S.E. Sirocco, or their severe gales from the N.W.

I have endeavoured to associate heat and electricity, as analagous in some properties, and I think I am warranted in extending it somewhat further by assigning a polarity to heat, by which is meant, according to the usual definition, "that quality of a body in virtue of which peculiar properties reside in certain points, usually as in electrified or magnetised bodies."

The fact of a cold and a hot point co-existent, the

Digitized by Google

simultaneous concentration of heat in the focus of one area, and the concentration of cold in the focus of another area, and the conjoint effect or action being co-temporaneous, and limited to the same day, and probably to the same hour—all these confer upon heat the character of polarity, opposite states of equivalent quantities.

It may seem a great anomaly to suppose that at any time we receive an accession of heat from the Polar regions; but such may be the case, although it is repugnant to our ideas.

Degrees of heat are absolute quantities, temperature is a relative effect, and it is well known that the polar regions are remarkable for extreme fluctuations of temperature, the range of the thermometer in the winter months being sometimes as much as 60° or 70°. If it is true, as we have endeavoured to show, that any given area of the atmosphere, losing 10° or 20° degrees of heat, and that those degrees are transferred to some other area, it is quite immaterial where those 10° or 20° of heat come from, whether from air 20° below zero, or from air 40° above zero. The heat can be transferred without the air. For if when the thermometer sinks to 20° below zero, and it subsequently requires 20° of heat to bring it back again, then those 20° which it lost must have raised the temperature of some other place. We have no knowledge of any such thing as a real zero, or 0, *i.e.*, where there is no heat; the idea is a mere metaphysical abstraction; it may be a convenient point of reference, and the freezing point of water would seem to be the most rational.

Digitized by Google

The subject we have been considering may not be without some practical value, in a mental or even moral point of view, as tending to rectify a general misapprehension that the climate of England is much more changeable and variable than any other, and this is apt to give rise to undue complaints and sometimes to reproach.

Nothing can be more incorrect, for it is a positive law that our climate, or the weather, cannot change without an equal change in some other part, and that all are subjected to the same vicissitudes as ourselves in turn, within the temperate and frigid zones.

Taken on the whole, the climate of England is favourable to health, longevity, and enjoyment—and that for our latitude we have the mildest winters of any place on the globe, and that the variations of temperature are within a moderate limit; but with this seeming disadvantage, that the variations are around and about the freezing point, say from 10° above to 10° below; hence, very great apparent changes, of one day frost and snow, and next mild, soft, and thawing. Whereas in the colder climates a variation of 10° or 15° does not raise the temperature to the thawing point; hence, the frost continues more permanent, although the change of temperature has been as great or greater than our own. This with our moist atmosphere and cloudy skies are our chief characteristics.

But what an immense advantage have we in the exemption from severer and more continuous cold, which would freeze our harbours, and impede our

Digitized by Google

commerce, and suspend the occupation of many of our people.

The general excellence of our cattle and flocks; the abundance of winter feed, and the state of vegetation, and the multitude of fine and useful products, all speak in favour and in commendation of our climate.

God's bountiful care,
What tongue can recite;
It breathes in the air,
It shines in the light.
It streams from the hills,
It descends to the plain;
And sweetly distils,
In the dew and the rain.

Frail children of dust,
And feeble as frail;
In thee do we trust,
Nor find thee to fail.
Thy mercies how tender,
How firm to the end;
Our Maker, Defender,
Redeemer and Friend."

GRANT.

The propositions of the transfer of atmospheric heat is one of the most important properties of that great agent of nature. It conveys the idea of the independent and inherent power of heat, and its attribute of motion. It is the great locomotive agent and power of nature. It urges forward the railway train surmounted by its trailing and graceful plume of steam, and it causes those mighty and majestic winds that sweep along at the rate of 50 and 60 miles an hour, bearing

Digitized by Google

from the great abyss of waters, or it plays in those gentle zephyrs that sigh so softly on the summer's eve. Thus heat—with steam and pressure—produce all the motions of the atmosphere, and from the transfer of heat all motion is derived, because it must move first in order to put other things in motion. It is the prime mover.

The air of a room may be cold, quiescent, and stagnant; light the gentlest spark of fire, and motion begins; the fire draws the air it quickens, and a draught or current of the whole is soon established. What the fire does to the room, the glorious sun does to the earth and atmosphere. For the present we must receive the fact of the transfer of heat as a simple proposition which will hereafter come under full consideration. Heat, then, is as a spirit that has wings of its own and flies away by itself through the air.

The doctrine of the transfer of the atmospheric heat, if accepted to its full extent, leads to the self-evident conclusion, that there is only a definite amount of heat—a constant and unvarying quantity—and in adopting this principle we only associate heat with electricity, for it is a fundamental law, that no one body can become charged with a greater amount of electricity, unless some other body has lost that quantity. Hence the law of definite quantity applies equally to heat and electricity, and connects them with the definite proportions and chemical equivalents of matter, which are the basis and the perfection of modern chemistry.

Digitized by Google

CHAPTER II.

Inducements to the Study of Meteorology—as a Field of Intellectual Research —and Pleasureable Pursuit—and from the Variety and Beauty of its Picturesque Scenery.—Epitome of the year 1814 from Howard's Tables.—Analysis of the Epitome—and the Evidence of a Majority of Recurring Days of Highest and Lowest Barometer and Thermometer—showing the tendency to a Periodic Action.—The Consecutive Series or the Order of Time in which the Different States—or the Cardinal Points of the Months occurred, exhibiting the Discrepancies between the Barometer and Thermometer.—Observations and Remarks relative to the differences and irregularities of the Instruments—and their want of Concord—which, like the motions of the Heavenly Bodies, is more apparent than real.—The Upper and Lower Regions of the Atmosphere exhibit frequently diverse states of Temperature.—Milton's idea of the Magnetic Powers of the Sun's rays confirmed by Professor Faraday's Researches on the Magnetic Conditions of the Atmosphere—and the Sun's action on the Needle.—Explanation of the Discrepancies by Strata or Beds of Air of equal volumes of unequal Temperatures and varying Densities.—A System of Compensation whereby the volume or measure of the Atmosphere is maintained under varying states of Pressure.—The Tropics.—the Temperate and Polar Regions have specific actions and characters in respect to the Atmosphere.—List of celebrated Frost Fairs on the Thames.—The last great Frost Fair of 1814—Detailed account of.—Severity of the Winter of 1814 in the North of Europe.

Digitized by Google

Digitized by Google

CHAPTER II.

HAVING in the preceding chapter taken a cursory view of some general facts, with popular demonstrations, I have now to enter upon the more rigid course of evidence in full. In all the tables and registers which I give, I am solely indebted for the figures to those already published by the best and most eminent authorities; consequently, they are accessible to all persons desirous of collating them with the inferences I have deduced. I have searched through a period of more than forty successive years, from 1810 to 1856, and find the same general result in each year; but as it would be unnecessary, and more especially expensive, to publish so long a detail, I have selected a few of the more memorable remarkable years as the witnesses in the case I have undertaken—premising, that the testimony of all would be to the same effect. The figures are fairly and honestly given, the errors being unintentional.

The tables of the barometer and thermometer for

Digitized by Google

the year 1814 are entirely from "The Climate of London," by Luke Howard, 1833; a work of considerable ability and fidelity. It is the best and most important work extant, and contains a large mass of valuable facts extending from 1806 to 1830.

It has been a matter of great surprise to me, that meteorology should find such little favour with the public in general, considering how much the weather is the subject of conversation. The beauty of the scenery of the sky, and grandeur of the scale of the atmospheric actions, their amazing variety and elegance, and the admirable laws which pervade and regulate the motions of the air, are every way worthy of our admiration and study, even as a pleasurable pursuit. Whether the extremely dry and dull detail of mere figures from day to day has deterred many from such an uninteresting exercise of mind, or whether such an unsatisfactory exhibition, without one useful inference, one ray of light to cheer the student through the long roll of figures, has been the case, I know not, but certainly the subject has but little claim upon public patronage.

I cannot conceive why the meteorologist, who is in possession of two of the most delicate and accurate instruments, should neglect the important part of analyzing his day's work; of endeavouring to ascertain and to account for the differences between the instruments on two successive days; to investigate why to-day differs from yesterday; what has caused the different aspects of sky; and to introduce into his dry

Digitized by Google

register some notice of the face of the sky—of those pictures, so lovely, so enchanting—some notice of those fleeting clouds; those banners, or storm flags, and their rapid alterations—the signals of the electric line which present a series of dissolving views, aerial tints and ever-pleasing hues. A multitude of pictorial effects are daily exhibited; but notice is rarely taken of them—no explanations are attempted, and no instructive observations. Surely, these in part are omissions, and might be made useful adjuncts to the register of the instruments.

Besides the mere local observations, mere isolated facts are of small value, meteorology requires an expansive intellect; a spirit of research and inquiry into things abroad, distant, and wide apart; the habit of comparing those with our own opens a wide and instructive field of research, rich in valuable results.

The chemist appeals in all his analytical researches to the balance—that is his unerring test. What balance so delicate and true as the barometer? why not then use it as the chemist? What instrument more useful to the chemist than the thermometer? Is not specific gravity the practical test of everything in nature? and the temperature of a body is the element of its specific gravity.

And yet, with these two instruments of unrivalled excellence, the meteorologist does not avail himself sufficiently. The great object is to analyze the figures, states, and conditions, as we do any natural substance.

Digitized by Google

AN EPITOME OF THE YEAR 1814, FROM HOWARD'S "CLIMATE OF LONDON"; OR THE DAYS OF HIGHEST AND LOWEST BAROMETER AND THERMOMETER.

DAY.	MONTH.	BAROM-ETER.	THER-MOMETER.	MONTH.	DAY.
1813.					1814
4	November	30·34	58	November	8
16	,,	29 02	25	,,	29
26	December	30·49	54	December	18
3	,,	29·09	19		29
1814.					
1	January	30·17	41	January	29
29	,,	28·22	8	,,	9 & 22
17	February	30·42	50	February	8
28	,,	29·12	18	,,	23
16	March	30 42	60	March	30
2	,,	28·97	21	,,	7—12
10	April	30·28	74	April	13
16	,,	29·23	32	,,	8
10	May	30·42	70	May	28
6	,,	29·28	31	,,	25
24	June	30·27	85	June	14
20	,,	29·50	36	,,	9—24
23	July	30·15	91	July	28
20	,,	29·56	42	,,	2
31	August	30·24	80	August	1
24	,,	29·40	37	,,	28
1	September	30·24	75	September	20
24	,,	29·52	33	,,	13
3	October	30·20	67	October	14
19—24	,,	29·09	24	,,	9
10	November	30·28	54	November	15
30	,,	29·18	19	,,	22
31	December	30·18	56	December	13
28	,,	28·94	25	,,	6

Digitized by Google

ANALYSIS OF THE EPITOME OF THE YEAR 1814; OR THE RECURRING PERIODIC CRITICAL DAYS, AS INDICATED BY THE BAROMETER AND THERMOMETER.

THE BAROMETER.

DAY.	MONTH.	*
4	November	+
3	December	—
1	January	+
29	January	—
28	February	—
17	February	+
16	March	+
16	April	—
10	April	+
10	May	+
20	June	—
20	July	—
24	June	+
23	July	+
24	August	—
24	September	—
1	September	+
3	October	+
30	November	—
31	December	+

BAROMETER:
Twenty out of Twenty-eight dates are recurring days.

THE THERMOMETER.

MONTH.	DAY.	*
November	29	—
December	29	—
January	29	+
January	9	—
February	8	+
January	22	—
February	23	—
March	12	—
April	13	+
May	25	—
June	24	—
July	28	+
August	28	—
July	2	—
August	1	+
September	13	—
October	14	+
November	15	+
December	13	+

THERMOMETER.
Nineteen out of Twenty-eight dates are recurring days.

* *Maximum* +. *Minimum* —.

Digitized by Google

To the Epitome I have prefixed the two last months of 1813, in order to show their natural connection with the winter season, of which they formed a part. The table presents an array of figures which seem to import little, and to be a barren, dry, uninstructive abstract. But although such may be the first impression, a little consideration will induce a more favourable opinion of their value and utility. They are the recognised and usual meteorological results, and may be consulted as faithful records of the past, and as the guides to future experience. They are the four cardinal points, and embody the specific characters of the months.

Each term of the barometer, or thermometer, may be regarded as the "symbol," or sign, of an element, or state of an element; and all the four terms become the "formula," which would represent the constitution of the month in abbreviated characters.

I shall refrain from any further remarks upon the epitome until I have given an analysis, or rather an accordance of the dates affixed to the table, shewing, although time is an element, but that *order* is heaven's first law, and which presides over time and space alike.

If meteorologists could be induced to adopt some uniform mode of recording their observations, and a system of well-arranged symbols and formula expressive of facts, and especially of a method of delineation, instead of so many figures, much benefit and advantage would result. The leading facts would be much more obvious, and address themselves to the senses, and admit of com-

Digitized by Google

parison and analysis. But at present there is such an heterogeneous mass of figures, that confound and repel most students.

The Analysis displays a different arrangement of the days of the month, and conveys the idea of a tendency to a recurrence, more or less frequent, of certain obvious and marked states of the atmosphere, as pourtrayed or indicated by the barometer and thermometer. The extreme points are taken in the same manner as that of high and low water of the tides. They are the most proper, the most correct, and most suitable for the purpose, and the ones usually adopted and recognised.

We cannot fail to perceive the broad and general fact that the same day occurs sometimes in succession for two or three months. Or that the following, or approximate days, of two or three months are the same, showing that there is a tendency to a periodic action in the atmosphere; and the little sections of the Analysis are the groups of approximate days of the respective months.

These days of highest and lowest barometer and thermometer I propose to regard as critical days; and their recurrence about the same day, as the periodic critical days, or recurrent monthly periods of the average of thirty days, extending, in their extreme range, from twenty-eight to thirty-two days—altogether five days. But I am more generally disposed to limit it to a day before and a day after, contracting the extreme range to the limit of three days.

Digitized by Google

But when we consider the small amount of 1° of temperature of Fahrenheit's thermometer, it is very remarkable that the critical days should occur so accurately within such a narrow compass, for 1° of temperature can only be regarded as a point. And this extreme precision gives a value and importance to the fact of recurring, or periodical, critical days.

The days on which the highest and lowest barometer and thermometer occur, are called the critical days of the month; there are, of course, two critical days pertaining to every month, both of the thermometer and of the barometer. And these two instruments rarely accord.

The barometric critical days differ from the critical days of temperature, and each must be distinguished and separated accordingly; although occasionally there is an accordance between the two.

The critical days indicate a change, and may in time lead us to judge of the coming states of the weather. They form an important feature in meteorology, and open a wide and extended field of useful inquiry.

The records of the past may become the heralds of the future, and the vestibule leading to the knowledge of the laws which regulate and pervade the atmosphere. We cannot reject the testimony of the Analysis of the year 1814, as we perceive the day of highest barometer of one month is answered by the same or following day of next month being the lowest barometer; or two or three months in succession present us on

Digitized by Google

the same days, or approximate days, with a repetition of the same state of barometer or thermometer, as respects their highest or lowest indication.

Thus 24th June, day of highest barometer, is succeeded by— 23rd July, day of highest barometer.
24th August, day of lowest barometer.
24th September, day of lowest barometer.
24th October, day of lowest barometer.

Now these cannot be casual coincidences, especially as we observe a repetition, on a smaller scale, on many occasions.

THE CONSECUTIVE SERIES, OR STATE OF THE INSTRUMENTS WAS AS FOLLOWS, FROM NOVEMBER 1813 TO FEBRUARY 1814.

DAY.	MONTH.	INSTRUMENT.	STATE OF INSTRUMENT.
4	November	Barometer	+ highest 30·34 inches.
8	,,	Thermometer	58° + highest.
16	,,	Barometer	— lowest 29·02 inches.
29	,,	Thermometer	25° —
3	December	Barometer	— 29·09 inches.
18	,,	Thermometer	54° + highest.
26	,,	Barometer	+ highest 30·49 inches.
29	,,	Thermometer	19° — lowest.
1	January	Barometer	+ 30·17 inches.
8	,,	Thermometer	8° — lowest.
22	,,	Thermometer	8° — lowest again.
29	,,	Thermometer	41° + highest.
29	,,	Barometer	— 28·22 inches.
8	February	Thermometer	50° + highest.
17	,,	Barometer	+ 30·42 inches.
23	,,	Thermometer	18° —
28	,,	Barometer	— 29·12 inches.

Digitized by Google

The consecutive series offer a very puzzling field of research—difficult, and in some degree vague and hypothetical, until we are better acquainted with the facts, and have some certain and acknowledged data to depend upon.

Assuming, however, that the quantity of heat present in the superincumbent mass of the atmosphere rules and overrules the barometric action, we have an approach to a solution of the problem.

That different and opposite currents of air exist at the same time, we have abundant ocular demonstration of, and upper clouds, when observed by a transit pole, are frequently seen to be sailing along in an opposite direction to the wind below. Those who have ascended in a balloon have found the same state occasionally. "In the reports of the Regents of the University of the State of New York, observations were made on the direction of wind near the earth's surface, and also on the direction of the highest observed clouds at periods of four hours duration, commencing at six A.M. and ending at ten P.M., for five successive years. The westerly *surface winds* being to the easterly, nearly as two to one. But in the region of the clouds, during the same period, the westerly winds being to the easterly as twelve to one, showing that the main current in the cloud region is from S.W. or western quarter."

We are, therefore, not overstepping the limits of fair reasoning, in taking such a state as a step towards explaining the discrepancy between the thermometer

Digitized by Google

and barometer, and yet strangely enough asserting that heat is the governing principle of both.

But we must carry our ideas and thoughts at all times a little above and beyond the existing state of things—we must refine them, elevate them, exalt them, for there is in all the operations of nature some spiritual agency, invisible power, or remote action, which controls and regulates the mechanism and motions of material masses. This is the prerogative of man—his special and great endowment from the hand of his Almighty Maker. In this, man stands alone, amid all the creatures here on earth. Hence, are the fine conceptions of the poets, and the anticipations of the soul. Hence, are the thoughts that precede for ages the realisation of the ideas of men who are sometimes far in advance of the period in which they live. Thus the great poet Milton ("Paradise Lost," book 3,) speaks of the magnetism of the solar rays, with almost divine prescience.

The golden sun, in splendour likest heaven
Allured his eyes, ...
. . . where the great luminary,
Aloof the vulgar constellations thick,
That from his lordly eye keep distance due,
Dispenses light from far. They, as they move
Their starry dance, in numbers that compute
Days, months, and years, towards his all-cheering lamp,
Turn swift their various motions, or *are turned*
By his magnetic beam, that gently warms
The universe, and to each inward part,
With gentle penetration, though unseen,
Shoots invisible virtue even to the deep

Digitized by Google

What a thought! and how bold and imaginative, and yet how true, though then unproved; but now it is well-known that the solar rays have a power to affect the magnetic needle, and make it bend obedient to its presence, daily homage paying to the great luminary. We cannot possible adduce higher nor better authority for the fact than Professor Faraday, who, in his Researches on Atmospheric Magnetism, speaks in the following manner :—

"In reference to temperature and its effects on the magnetic condition of the air, and through that on the needle, it is not the local temperature which is supposed to influence the needle, but that which affects enormous masses of air above as well as below, and of which the temperature at the spot, however important it may become when we properly interpret it, gives us as yet little or no knowledge.

"The changes in the temperature produced by the sun will not take place above and below at the same time. The upper regions are affected before the air below is heated; and therefore the effect from above would be expected to precede that below. The change observed on the earth does not show us, for the same time, the course of the changes above, and may be a very imperfect indication of them.

"The maximum temperature below is often two, three, or four hours after the sun, whereas, whatever heat the sun gives by his rays directly to the atmosphere, must be acquired far more quickly than that.

"It is very probable, and almost certain, that at four

Digitized by Google

or five A.M. in the summer, the upper regions may be rising in temperature, whilst on the surface of the earth, through radiation and other causes, it is falling. The well-known effect of cold just before sunrise is in favour of such a supposition. It is not the absolute temperature of the air at any spot that renders it influential in producing magnetic variations, but the difference of temperature between it and the surrounding regions. Though the upper regions be colder than the lower, their changes may be as great or greater; they happen at a range of temperature which is probably more influential than a higher range; and, what is of importance, they occur more quickly and directly upon the presence of the sun. The quantity of heat which the atmosphere can take directly from the sun's rays is indicated by the different proportions we receive from him when he is either vertical or oblique to us, and so sending his beams through less or more air; and when he has departed, the upper parts of the air are far more favourably circumstanced for rapid cooling by radiation than the portions below. So that the final changes may be as great or greater than below, and we may learn little of them, or their order, or time, by observation of temperature at the earth's surface. In addition, therefore, to observations of magnetic effect, there are apparently reasons deducible from physical causes why the chief seat of action should be *above*, in the atmosphere. The air, as heated by the sun, must be in this condition. According to analogy with solid and liquid bodies, being

Digitized by Google

exposed to heat and then withdrawn, the changes of temperature that it would undergo would be more rapid in the elevation than in the falling, and so the changes in the preceding would be more rapid than in the following parts. To this would be added the effect of the atmosphere warmed by the earth; for, as that is slower in attaining heat, as is shown by the time of maximum temperature, so its effects being gradually communicated to the air above, as the sun passed away, would tend to retard its fall, and enlarge the difference already spoken of. Applying these considerations to the natural case, the strongest effect and greatest variation should be towards the west, and the following or lesser action towards the east of the sun; and the mean condition of the needle for the whole change would be in advance of that body. The progress of daily variation is *first* at the higher station."—*Faraday.*

Applying these just and admirable observations on the temperature of the different regions of the atmosphere to the explanation of the actions of the barometer, we find a key to the problem. For if these variations of temperature affect the magnetic needle daily, and we may say, almost hourly, and diversely at different seasons; then, if the mode of reasoning is admissible in the one case, it is doubly so in the other, or in that of the barometer.

I shall not attempt to unravel the whole of the consecutive series—they present a difficult problem—but shall be content with one or two endeavours.

Digitized by Google

It is generally supposed that a high barometer is dependent upon a cold and somewhat dry dense atmosphere, and in proportion to the height of the barometer is the volume of cold air, or its intensity, etc. A low barometer, therefore, is connected with a warm and moist atmosphere, either in volume or intensity. Hence the barometer and the thermometer are, as respects their indications, opposed to each other. A high barometer and low thermometer, a low barometer and high thermometer, are natural associates. But this rule is not observed, or, at any rate, is not indicated by the instruments, which we perceive, by the table already given, very rarely accord. There is, therefore, a discrepancy and an anomaly. Whatever theory or view we adopt we shall meet with the same difficulty, for the consecutive series present no appearance of order, except the mere order of time of succession.

We therefore are compelled to adopt the view of Professor Faraday, and have every reason to believe it to be perfectly consonant to nature, and adequate to the full explanation of all the complex and diverse cases. The table from November, 1813, to December, 1814, a period of fourteen months, gives only one instance in which the barometer and thermometer acted in unison, and simultaneously, or on the same day. On 29th January the barometer was lowest for the month, and the thermometer highest. However delicately the barometer in its horary or diurnal oscillations in the tropics may follow the variations of temperature, it is evident, from the consecutive series, that no such state

Digitized by Google

obtains in our own climate—there is a wide disparity of action, and no concord. We are, therefore, inclined to suppose that as great fluctuations of temperature take place in the upper regions of our atmosphere as below; but that in the tropics the same general equanimity, and uniform temperature exists in the upper strata as prevails in the lower.

In our own climate it may be cold below and comparatively warm above, or warm below and relatively cold above, and these conflicting strata act in the mass upon the barometer, which represents the absolute weight of the whole column of the atmosphere, whatever be its height, density, or temperature. Whereas the little delicate thermometer merely records the state of the medium in which it is placed. The atmosphere in the temperate and polar regions differs, in some degree, from the tropics, in its laws and actions.

The year 1814 is distinguished from all in the present century, from 1800 to 1857, by being the only one which has enjoyed the celebrity of a fair upon the Thames in consequence of the protracted severity of the winter. As these fairs are happily of a rare occurrence, a few observations are not irrelevant to our subject, especially as the mere epitome of the meteorological register would not convey any adequate or correct idea.

A little detail serves to enliven the matter, and illustrates in a very pleasing and instructive manner an important natural and national epoch. In the list of these frost fairs upon the Thames there is one uniform fact, that they all terminated early in February, as 6th

Digitized by Google

or 8th—that, for the most part, they began on the first week of December, or with preparatory signs in November, and lasted generally about from eight to ten weeks.

1683-4. Severe Frost from beginning of December to 6th February; an ox roasted on the ice; a whole town erected on the Thames, streets, shops, etc. Coaches plied on the Thames; bull baiting, horse racing, Bacchanalian triumph and a grand carnival. Charles II. and his court visited the fair. On February 6th, the day after the breaking up of the frost, Charles II. died, and James II. was proclaimed.

1688-9. A great frost from December 20th to February 6th, coaches and waggons plied regularly on the Thames, the ice 18 inches thick.

1715. A large frost fair on the Thames. Frost from November 10 to February 9.

1739-40. A frost fair, ox roasted, printing presses.

1789. January 8th. The Thames frozen, and a great fair was held; booths, shows, wild beasts, bear-hunt, etc.; the frost lasted six weeks.

1814 is the last frost fair, and of which we propose to give some particulars, which may be regarded as the type and exemplification of the preceding ones, and in all probability of any and all succeeding ones. So little does nature or man vary that one account will suffice for all.

Digitized by Google

THE GREAT FROST AND FAIR ON THE THAMES, 1814.

We perceive by the Epitome which we have given that the highest barometer was on the 26th December, 1813, which denoted the accession of a lofty body of cold air, which produced a precipitation of the vapour of the lower regions, and occasioned a most prodigious dense fog, so that the darkness of the day was as that of night —especially in London. All pedestrians carried links or lanterns; horses in coaches were obliged to be led. This fog was so black and thick as almost to be felt. It was a horrid London dry fog, and continued until the night of the 31st, when a light breeze from N.E., and increasing cold and dryness of the air, dispersed it.

But January began with light mists, more or less every day, which rendered travelling extremely dangerous, and the air was loaded with frozen particles, which attaching themselves to all objects, covered them with rime, or beautiful and delicate crystals; the trees and shrubs were completely coated, and had a most elegant and picturesque appearance, the twigs seeming like white coral. The evergreens were absolutely encased in ice, as if they were in transparent varnish, and the loftiest trees appeared grand and magnificent objects in this new livery, and the whole of nature was dressed in a variety of exquisite devices of frost work, which was the admiration of all beholders. But at length the sun broke out and loosened the rime, which fell unmelted, and lay upon the ground in large

Digitized by Google

heaps under the trees; after which a deep snow, brought by an easterly wind on the 4th of January, reduced the whole scene to the more ordinary appearance of our winter.

4th, 5th, and 6th. The snow continued falling, more or less, and presented an amusing phenomenon; for instead of driving loose before the wind, it collected occasionally into little balls, which were rolled along the ground by the wind, till the increasing weight and bulk stopped it. Thousands of these natural snow balls were seen lying about in the fields, some of them being several inches in diameter. The snow fell continuously for 48 hours.

On the 9th of January the thermometer in the snow at night was as low as 5, and the air 8°. Barometer 29·3.

The frost continued steady with a day temperature of about 30°, and the night temperature 20°.

On the 12th of January the river Lea was completely frozen over, and the Thames was much encumbered with ice; the ponds and rivers were all frozen. Trade in all the streets was nearly stopped; few carriages or coaches could now travel. Immense icicles were suspended from all the buildings, the water pipes frozen, etc.

Skating was pursued with avidity; ladies robed in the richest furs frequented the Serpentine and performed reels, dances, and quadrilles with the utmost elegance and precision, and made various devices and figures on the ice, and carved out the letters of the alphabet and words.

Digitized by Google

The coaches on most of the roads ceased running, and about Birmingham and Coventry the snow drifts were said to be in some spots 24 feet, and impassable.

The snow even in the street of Dublin was 6 feet in depth, and the number of deaths from cold and distress was very great. There were 80 funerals on one Sunday in Dublin, and the coffin-makers could not complete their orders, and multitudes of the poor lay unburied.

From the 13th to 21st the thermometer ranged from 36° to 11°, and on the snow 6°.

On the 22nd a little snow fell, and the temperature fell to 8°.

26th and 27th. S.W. wind, and the thermometer rose to 36°. Thaw and extensive floods.

29th of January, day of minimum barometer 28·22. Stormy S.E. wind, with snow and rain.

30th. The barometer began to rise as the wind drew round to S.W. and ultimately to W.N.W. Strong gales with hail squalls.

February began with hoar frost and extensive rime. On the 3rd, a thermometer on the snow was only 2°.

On the 4th, temperature 12°. Mr. Howard exposed in a metallic dish 2600 grains of snow, which had become very hard by freezing; in ten hours, the temperature having risen to 28°, the snow had lost 27 grains in weight, showing the amount of evaporation from snow.

On the 6th and 7th of February a gale S.W. with rain. Temperature 40°.

Digitized by Google

On the 8th, temperature 50°, S.W. and frost gone.

The fair began on Sunday, 30th of January. The immense masses of ice that floated down from the upper part of the river, in consequence of the thaw of the 26th and 27th, completely blocked up the Thames between Blackfriars and London Bridges, and as the frost immediately set in again, it cemented the pieces of ice together, and presented a complete surface of ice in a day or two, and multitudes of persons walked over the Thames.

By the 1st of February, the bosom of old Father Thames presented a very busy scene, and a large town was erected, and a vast multitude thronged to the fair, which extended from Blackfriars Bridge to London Bridge. Sheep were roasted, and the delicate meat was sold at 1d. per slice, and called Lapland mutton, and found a ready sale. Highly ornamental booths were erected; mirth, merriment, and fun seemed to pervade the whole mass, and all was glee and joy. Swings, dancing booths, skittles, and every gaiety belonging to a fair. Thousands and tens of thousands were present night as well as day, dancing, gaming, drinking, etc., etc.

Printing presses were erected to commemorate the great fair, and the following is a specimen of one of the hand bills:

"Printed to commemorate a remarkably severe frost, which commenced 27th of December, 1813, accompanied by an unusual thick fog, that continued eight days, succeeded by a tremendous fall of snow, which prevented all communications on northern and western

Digitized by Google

roads. The Thames presented a complete field of ice between London and Blackfriars Bridges on 31st of January. A fair is held this day, 4th of February, and the whole space between the two bridges is completely covered with spectators."

On Saturday, 5th, the wind suddenly veered to the south, rain began to fall and the ice to crack, and all of a sudden it floated away—printing presses, flags, and booths—to the no small dismay and grief of the people. With this appeared the following *Jeu d'esprit.*

"TO MADAM TABITHA THAW.

"Dear dissolving Dame—Father Frost and sister Snow formed an idol of ice upon my bosom, and all the lads and lasses of London came to make merry. But now, as you love mischief, treat the multitude to a few cracks, and by your gracious visit obtain the prayers of the poor upon both banks.

"Given at my own press, 5th of February.

"THOMAS THAMES."

The thaw advanced rapidly, and on Sunday the 6th, thousands of persons thronged the banks, and sighed at the sudden and unlooked-for destruction of the frost fair.

On Monday, 7th, old Father Thames attained its wonted fluidity, and looked as cheerful and busy as ever, and the sons of commerce pursued their avocations, and the relief afforded to the labouring population was a source of heart-felt gratification and thankfulness. The mischief done on the river was estimated at £10,000.

The following passage in one of the leading journals announced the opening of the river :—

Digitized by Google

"Feb. 11.—We are happy to see the lately perturbed bosom of Father Thames resume its former serenity. The busy oar is now plied with its wonted alacrity and the sons of commerce are pursuing their avocations with redoubled energy. Cheerfulness is seated on the brow of the industrious labourer: those who were reduced to receive alms as paupers, again taste the sweets of that comparative independence with which labor crowns the efforts of the industrious. What a fruitful source of congratulation does this prospect afford! Nor can the contemplative mind dwell on the subject without feeling gratitude to that beneficent Being, who, in a time of such calamity, opened the hearts of the benevolent to administer from their abundance, to the necessities of their poorer brethren, and thus add cement to the bond by which all mankind are linked together."

Mr. James, in his work of "Travels in Sweden," etc. says:—"It is impossible to recount the horrors of such a winter as this of 1814, and no example has occurred within the last sixty years of one so severe. The peasants came into Stockholm with their faces, arms, and legs frozen; the soldiers on guard were relieved every hour, yet many were frozen to death. Frequently, we saw the dead white patch on the cheeks, ears, and noses of the poor. The gentry wore masks, or their skins were greased with oil. Salutations in the street were short, scarce a word or an answer; the N.E. wind was like the chill blast of death."

Mr. James crossed the grand channel that separates the Aland group from Sweden, which is forty miles

Digitized by Google

broad and of a great depth, so that it is rarely ever frozen. But this year it was one mass of ice, which no one living recollected before. On the 21st of January the Fahrenheit thermometer was 28° below zero, and at St. Petersburg, 42° below.

But the season had its blessings, for the season was not interrupted by a single thaw, so that the poor kept their provisions untainted in the frozen state and fit for market, which was their chief dependance.

"But 40 years have fled since the great frost fair and its snowy fabrics have melted away, and of all who danced there how many are there now alive; but, as it would never do to live for ever, let us live well and wisely.

"The old-fashioned winters are said to have passed away, when the slides were a quarter of a mile long on level meadows, and when the snow-drifts formed pillared porches like in fancy to the Parthenon, and its roof strewed with diamonds. In these the boys assembled together, where old airs were sung, and tales were told of goblin, ghosts, and fairies. On a throne at the upper end sat young Christopher North, then king of boys, and proud were his subjects to do him homage. Oft did he tell his tales in the Snow House, and preside over the fantastic festivities, and delight in the jigs and the reels which enlivened the hours."

Digitized by Google

CHAPTER III.

Howard's Table of the Climate of London, 1819-20.—Recurring Periods.—Early Winter.—Thermometer at zero.—Thunder Storm.—Abstract of Meteorological Table at Melville Island, 1819-20.—Analysis of, and abundant evidence of Recurring Periods.—The Temperature at Melville Island.—Commencement of Winter.—Cutting a Canal through the Ice.—Frost Smoke.—Effects of severe Cold on the Human Body.—S.E. wind.—Warmth of.—Christmas Day.—Progress of the Season.—End of Winter, 24th May.—Range of Summer Temperature.—Light at Melville Island during the absence of the Sun for eighty-four days.—Rapid increase of the Light, to continued light of one hundred and fifty days.—The great amount of Light at the Pole and in the Polar Regions.—Its assumed Effect and Magnetic Connection.—The Aurora Borealis at London and Melville Island simultaneously.—Tendency to Periodicity; or recurring Monthly Periods of the Aurora.—Meteors, their connection with, or relationship to, the same agency as the Aurora.—Light in Heat and Electricity; their condition peculiar in the Polar Regions.—Theoretical or hypothetical views of the action of the Atmosphere in the Polar regions.—General view of the Climate of Melville Island.—Its former Tropical state, as indicated by the Geological remains, and formation of Coal, etc.—Utility of the Voyage, and establishment of Melville Island as the First Point of the N.W. Passage.—£5000 Parliamentary grant.

Digitized by Google

Digitized by Google

CHAPTER III.

In reference to the table of the Climate of London in the years 1819-20, given in page 52, Mr. Howard remarks that the winter began with the deep snow of 21st 22nd October, 1819, and ended with the deep snow, followed by a thaw, February 21st, 22nd; the winter having lasted one hundred and twenty days, commencing sixty days before the shortest day and ending just sixty days after, having some mild periods intervening. The heavy snow of October 21st was preceded by a rapid fall of the barometer, which was the prelude of winter, and, indeed, it had all the appearance of mid-winter, with the exception of the foliage still remaining on the trees, which, mingled with the enormous burden of snow, presented a singular and grotesque appearance. Much damage was done by the breaking down of large limbs from fruit and forest trees in all directions. The swallows added to the picturesque scenery by flying about in all directions amid the snow.

Digitized by Google

DAYS OF HIGHEST AND LOWEST BAROMETER AND THERMOMETER, FROM SEPTEMBER, 1819, TO AUGUST, 1820.—HOWARD.

BAROMETER.			THERMOMETER.	
DAY.	INCHES.	MONTH.	DEGREES.	DAY.
20	30·50	September	82	15—10
25	29·46	,,	33	19
17	30·30	October	77	10—12
22	29·28	,,	22	26
30	30·08	November	55	5—30
20	29·05	,,	21	23
2—3	30·20	December	56	20
22	29·18	,,	10	10—31
8	30·70	January	25	27
19	28·69	,,	—0 zero	15
15	30·31	February	53	23
24	29·30	,,	15	17
15	30·40	March	63	30
1—24	28·70	,,	21	6
23	30·50	April	72	5
8	29·10	,,	28	30
1—20	30·31	May	78	22
17	29·10	,,	26	5
25	30·40	June	91	25—24
1	29·47	,,	34	12
1	30·22	July	86	31
18	29·30	,,	40	1
9	30·28	August	81	15
28	29·41	,,	38	29

Digitized by Google

ANALYSIS OF THE PRECEDING TABLE.

THE BAROMETER.			THE THERMOMETER.		
*	DAY.	MONTH.	MONTH.	DAY.	*
+	20	September	January	15	—
—	22	October	February	17	—
—	20	November			
—	22	December	March	6	—
			April	5	+
+	15	February	May	5	—
+	15	March			
			March	30	+
—	24	February	April	30	—
—	24	March			
+	23	April	July	31	+
			August	29	—
—	1	May			
—	1	June			
+	1	July			
THE BAROMETER has 12 Recurring Periods.			THE THERMOMETER has 9 Recurring Periods.		

* *Maximum.* | *Minimum.*

Digitized by Google

It is well to compare this, by way of illustration, with Captain Parry's account. "The winter began at Melville Island, October 17th, ice forming round the ship at the rate of from three to five inches daily, and in one day eight inches were formed, the temperature being 12 degrees below zero. October 20th and 21st, were among the finest days which experience has since taught us ever occur in this climate; although the thermometer remained steadily at 15 degrees below zero, yet the day was rather pleasant to our feelings, as the weather was remarkably clear, and there was no wind. Our sportsmen were out the whole day, but returned without having seen a single animal."

There is one point in the table of January 15th, the thermometer being recorded at 0 zero, which is a most unusual condition in the climate of London; it may be regarded as nearly the lowest degree of cold we are visited with. About midnight of the 14th a brilliant aurora decorated the heavens, and displayed its vivid light from the N.W. The temperature at sunrise on January 15th, was a little below zero by Mr. Howard's thermometer at Tottenham; and Dr. Forster states that on the morning of 15th, at Hartfield, it was 10 degrees below zero. In bonnie Scotland, the 17th and 18th January, 1820, will ever be remembered, it was said, for it was the coldest night, and the thermometer was 10 degrees below zero; wind N.W. The windows were all closed up, and although a constant fire was kept, they were encased with ice even in the day. Many persons were frozen to death, and many domestic

Digitized by Google

animals the same, and the trees were reft. Dr. Wilson, at Glasgow, found that, by blowing with a pair of bellows on the bulb of a thermometer lying on the snow, the thermometer rose several degrees, which is in accordance with Parry's observation, that whenever a gale of wind blew from any quarter, the thermometer always rose several degrees.

In adverting to the zero of our climate, and the effects, we cannot help contrasting it with Captain Parry's account just given of the *pleasant* feelings when the thermometer was even 15 degrees below zero, and the sportsmen from the ships were out enjoying themselves. There is likewise to be borne in mind—and which in subsequent detail will be given—that this zero, which is such a hard point for us to feel, is absolutely the mean temperature of the whole year at Melville Island: and yet how cheerfully and well our noble friends endured it. How different can the same state, or condition, be viewed. What a happy adaptation of the mind and body to existing circumstances, and how little misery or real suffering there is when the will and disposition meet the events of life in a right spirit.

Mr. Howard's work has a few scanty remarks appended to each month, but by no means sufficient to enlighten or enliven the subject. On 31st August, 1820, we find, "Cirrocumulus; wind N.E.; temperature 72°; barometer 30·07, at London." But on 31st, at Folkstone, Howard says, "Very fine day, with Cirrus Cirrocumulus, etc. Went in a

Digitized by Google

boat under the cliffs eastward. Temperature of sea about 65°. In returning, between six and seven, a very thundery looking sky to westward, which the fisherman with us knew how to appreciate, saying, after a few minutes, that the storm would pass inland, which the clouds did in effect soon afterwards. Breeze, S.E. He said the *south-east*, if it blew fresh in *hot* weather, *always brings* up a tempest. We found this prognostic correct."

This is all Mr. Howard says: but in the "Gentleman's Magazine," of Sept. 1820, is the following account at page 176:—"Sunday evening, 31st August, 1820. Awful storm at ten to two, night, at London, Worthing, Maidstone, Sudbury, etc. Terrific lightning, awful and prolonged peals of thunder. Hail-stones of immense size, and pieces of solid ice, eighteen inches by six. The hail-stones lay several feet deep next day in places where they had drifted into a mass. The flashes of lightning and the rolling of the thunder; the cracking noise of the hail-stones and the ice was like the rending of timbers. A deluge of rain followed, sweeping everything before it. The hops were completely stripped off the poles, and standing crops destroyed; windows were shattered to atoms, trees were torn up and shivered, and several persons were killed. Two thousand dead sparrows were picked up in the streets and suburbs of Worthing on the subsequent morning. Many substantial buildings were rent and the metallic portions melted. One old rheumatic man, who had been confined to his bed for six weeks, received a shock from a stroke of lightning;

Digitized by Google

he jumped out of bed, and ran down stairs, and was cured of his rheumatism. The lightning singed his wife's hair, tore the locks off the doors, wrenched the hinges, and broke some of the doors in pieces. It filled the room with smoke and a strong sulphureous smell."

Surely such a manifestation of sublime power and grandeur of the atmospheric actions demanded some further notice than the frothy word "Cirrocumulus." The most important part of meteorology is absolutely omitted in the dry hieroglyphics of the tables, which are, in fact, very little better than inscriptions in an unknown tongue. We want a compendium of the facts, appearances, and occurrences, and a spirit infused into the subject; one would suppose the electric fluid might shake off the torpor and awake them, as it did the stiff rheumatic patient. Oh, the glory of the scenery is lost! Oh, that the sun-beams could make a photographic impression upon our minds and displace our lethargy! Those who glory in the battle, let them behold the glory of the storm, and the war of the elements. It may be observed that the S.E. hot wind, or sirocco, was, as previously stated, the electrode, the feeder of the storm, bringing up the supply from the hot regions of the deserts of Arabia and Egypt. The fisherman knew it!

Digitized by Google

THE DAYS OF HIGHEST AND LOWEST BAROMETER AND THERMOMETER, AT MELVILLE ISLAND, LAT. 74° NORTH; LONG. 110° WEST, FROM SEPTEMBER, 1819, TO AUGUST, 1820.

BAROMETER.			FAHRENHEIT THERMOMETER.		
DAY.	MONTH.	INCHES.	DEGREES.	MONTH.	DAY.
3	September	30·42	+37	September	3
20	,,	29·36	— 1	,,	26
22	October	30·32	+17	October	2
5	,,	29·10	—28	,,	29
6	November	30·32	+ 6	November	3
27	,,	29·63	—47	,,	19—20
29—30	December	30·75	+ 6	December	31
26	,,	29·10	—43	,,	30
16	January	30·77	— 2	January	1
24	,,	29·59	—47	,,	12—13
29	February	30·15	—17	February	1
12—13	,,	29·32	50	,,	15
28	March	30·26	+ 6	March	11
6	,,	29 00	—40	,,	1
27	April	30·86	+32	April	30
15	,,	29·40	—32	,,	10
1	May	30·48	+47	May	27
29	,,	29·25	— 4	,,	7
18—19	June	30·13	+51	June	22
7—30	,,	29·50	+28	,,	7— 8
9	July	30·01	+60	July	17
26	,,	29·13	+32	,,	14-29-30
17	August	30·03	+45	August	13
9	,,	29·46	22	,,	2

Digitized by Google

ANALYSIS OF THE DAYS OF THE HIGHEST AND LOWEST BAROMETER AND THERMOMETER, AT MELVILLE ISLAND.

BAROMETER.

MONTH.	DAY.	INSTRUMENT.
September	3	+highest
October	5	—lowest
November	6	+
September	20	— L +
October	22	+ L —
November	27	—
December	26	—
January	24	—
February	29	+
March	28	+
April	27	+ +
May	29	—
June	30	—
June	7	—
July	9	+
August	9	— L +

There are 16 Recurring Periods out of 24 exhibited by the Barometer.

THERMOMETER.

MONTH.	DAY.	INSTRUMENT.
September	3	+highest
October	2	+
November	3	+
January	1	+
February	1	+
March	1	—
January	13	—
February	15	— —
March	11	+
April	10	—
May	7	—
June	7	—
July	14	—
August	13	+
July	29	—
August	28	—

There are likewise 16 Recurring Periods out of 24, exhibited by the Thermometer.

The abstract is from the tables in "Captain Parry's Voyages of Discovery

Digitized by Google

THE BAROMETER AT MELVILLE ISLAND.

The highest barometer was	30·86 on 27th April.
Lowest . . .	29·00 on 6th March.
Extreme range . .	1·86

Both states occurring at about the same mean temperature of zero, the highest being on the warmest day of the two.

1819.

Sept. 20.—Day of highest barometer for the month at London 30.50

Sept. 20.—Day of lowest barometer for the month at Melville Island . . . 29·36

From the 20th to the 25th, at London, it underwent a rapid depression and attained its minimum 29·4. But at Melville Island the barometer rose from its minimum to 30·14, evidently showing a reciprocating action. And thus, again, on the same day in October they reciprocated.

1819.

Oct. 22.—Highest barometer, Melville Island 30·33

Oct. 22.—Lowest barometer, London . 29·28

The mean barometer of the year at Melville Island, was 29·86; July and August having the lowest mean and a smaller range than during the winter.

THE THERMOMETER AT MELVILLE ISLAND.

TEMPERATURE.

The highest thermometer was	× 60° on 17th July.
The lowest ,,	— 50° on 15th Feb.
	110°

Digitized by Google

The mean of the twelve calendar months between the parallels of 74° and 75° N. latitude, was + 1·33° above zero, as the thermometer on board was invariably higher than that on shore. It is stated in the abstract (269) that the mean temperature may fairly be considered as 2° below zero.

The lowest temperature registered on the ice was — 55° and it did not rise above —° 54° for 17 hours, February 14th and 15th.

During the lowest temperature above mentioned—which was the most intense degree of cold marked by the spirit thermometer during our stay — not the *slightest* inconvenience was suffered from exposure to the open air by a person well clothed, as long as the weather was perfectly calm; but in walking against a very light air of wind, a smarting sensation was experienced all over the face, accompanied by a pain in the middle of the forehead, which soon became rather severe. We amused ourselves in freezing some mercury and beating it out on an anvil. It did not appear to be very malleable, usually breaking after two or three blows from the hammer.

Commencement of Winter, 14*th September*, 1819.

September 14th, the thermometer sank to 9°. The sudden and unexpected decrease in the general temperature of the atmosphere about this period was a very striking one, and from this time the commencement of winter may fairly be dated (p. 85).

It is very remarkable that, September 15th, we

Digitized by Google

should have had at London, the temperature of 82° and lowest at night, 52°, both of which were extraordinarily high, and they are mentioned with the view of adducing them as a striking example of the transfer of temperature, or the reciprocating action even of these distant areas, of which innumerable examples may be given in illustration and demonstration of that principle of the atmosphere, which is one of its most important and peculiar laws. And in speaking of the barometer at the two places, from the 20th to 25th of September, we find a wonderful illustration of reciprocating or reverse action.

On 26th of September the thermometer fell to 1° below zero, and the ice had lately so rapidly increased that the crew were employed in sawing and sinking the ice in order to cut a canal for the ships. This they accomplished in the most heroic manner, officers and men standing up to their knees in water while the thermometer was 12° only!

In three days they completed the canal of $2\frac{1}{3}$ miles, the average thickness of ice being seven inches. At half-past three, on 26th September, they tracked the ships along and reached their winter quarters, and hailed the event with three loud and hearty cheers from both ships' companies (98), and gave the place the name of Winter Harbour.

Surely there are but few hearts that can peruse such narratives without feelings of exultation at the heroism of our countrymen and their deeds.

In the early part of October the animals and birds

Digitized by Google

migrate to the continent of America, leaving only the wolves and the foxes at Melville Island. The deer collect in herds, and are guarded and driven forward by a large stag, who strikes them with his horns to make them go on. Streams of vapour rose from the sea in the offing, which, previous to freezing, reeks like warm water. The frost smoke—or the barber as it is termed, from its frequently freezing in the beard, and almost removing the skin from its sharp spicula—is the vapour from the water of the sea, arising from an open space of water like steam from a cauldron, and is rendered visible by condensation at about zero, or 32° below the freezing point, but the frost smoke is not very dense at that temperature. This vapour freezes instantly at low temperatures, and, being driven by the wind, deposits itself in fine powder upon all objects like rime or hoar frost, but which, at the extremely low temperature, is very cutting and disagreeable.

During the winter, when the thermometer is at 24° degrees below zero, the smoke from the ships' funnels skimmed horizontally to a very considerable distance, and did not ascend in the slightest degree, which most probably was caused by the condensation of the vapour or moisture of the smoke, from the great degree of cold to which it was instantly subjected, and in some respects analogous to the frost smoke.

In October at Melville Island the snow begins to fall in very small spicula, and the cold increases in severity, so that severe frost bites occurred, and the effect that severe frost has in benumbing the faculties was very

Digitized by Google

striking. Persons looked wild, spoke indistinctly, and made irrational answers, so much so, that it was difficult to believe that they had not been drinking, so much does the state resembles that of stupid intoxication; torpor, drowsiness, and the fatal sleep of death follow the further continuance of the cold.

It is generally supposed by those who have not experienced the effects produced upon the feelings by the various alterations in the temperature when the thermometer is low, that a change of 10° or 15° makes no sensible difference in the sensation of cold; but this is by no means the case, for it was a remark continually made that our bodies appeared to adapt themselves so readily to the climate, that after living for some days in a temperature of 15° or 20° below zero, it felt quite mild and comfortable when the thermometer rose to zero, and *vice versa.*

On November 29th and 30th, we were occupied at night from five to seven hours in taking lunar distances in the open air, the thermometer being 36° below zero, and this we did without any material inconvenience as long as the weather continued calm, or nearly so. And we find February 22nd fine and clear, the thermometer 34° below zero in the shade, and 23° below zero in the sun; the walking was unusually pleasant. This is certainly a degree of pleasure we should not have anticipated.

These facts are given as wonderful illustrations of the power of the human frame to adapt itself to every and any condition of the atmosphere. And they display

Digitized by Google

the unutterable beneficence of God, who has so tempered the elements, and ordained that happiness and comfort may be, and is, found in every region and climate of the globe, of which this at Melville Island must be considered as among the most rigorous and severe.

A gale of wind, from whatever quarter it might blow, was almost invariably found to raise the thermometer several degrees, even when it came from the north as much as 14°. An E., S.E., or E.S.E. wind causes the thermometer to rise 40°, which produces a great deal of annoyance by the dampness from the ice thawing in every crevice.

I presume to differ somewhat from this, supposing the moisture or vapour of the warm S.E. wind is deposited upon the cold surfaces, as is stated, that whenever a blanket was brought on deck and suffered to remain there for a short time exposed to the air at the temperature of zero, or under, the immediate consequence, on taking the blanket again into the inhabited parts of the ship, was that the vapour settled and condensed upon it—rendering it almost instantly so wet as to be unfit to sleep on. Hence, everything had to be aired and dried upon lines between decks.

The quantity of ice collected on the Hecla's lower deck, upon the ship's sides, from the condensation of the men's breath and the steam of their victuals during meals, amounted to the enormous quantity of six hundred gallons in four weeks only.

On Christmas day the weather was raw and cold, with considerable snow drift, and we marked the day

Digitized by Google

in the best manner possible by drinking the health of all our friends in England. A piece of English roast beef, which formed part of the officer's dinner, had been on board since the preceding May, and preserved, without salt, during that period, merely by the anti-septic properties of a cold atmosphere.

January 7th, 1820, was one of the most severe days to the feeling which we experienced during the winter, the wind strong from the north, with a heavy snow-drift, the thermometer from 38° to 40° below zero. It is impossible to conceive anything more inclement than such a day, for we could with difficulty pass between the two ships. January 11th, the thermometer 49° below zero, but being calm, we walked on shore an hour without inconvenience, the sensation of cold depending much more on the degree of wind at the time, than on the absolute temperature.

Mr. Howard remarks that the winter of 1819—20 ended with the deep snow of February 20th, followed by a thaw on February 21st and 22nd.

Captain Parry remarks:—"On February 22nd the weather fine and clear, and though the thermometer was 36° below zero, and only rose to 23° below zero, in the sun at 2 P.M., the walking was unusually pleasant to our feelings. The 6th of March was the first day to which we could attach the idea of spring, and the thermometer rose up to zero, being the first time we had registered so high a temperature since December the 17th."

The depth of ice found in the middle of the harbour

Digitized by Google

on 25 feet depth of water was 6½ feet. And the depth of snow on it eight inches, a fair average.

April 30th, 1820. The thermometer rose to the thawing points, an event which had not occurred for the last eight months.

May 22nd. We had the satisfaction of being able to fill a pint bottle with water from a small pool of melted snow, the first time for the last eight months. In England, May 22nd was the hottest day, and the warm period occurred at the same time.

May 24th. The clouds had a watery appearance, and at half-past eight in the evening we had the satisfaction of being surprised by a sharp shower of rain, which was a matter of such considerable curiosity, that every person on board hastened on deck to witness so interesting a phenomenon. And the winter may be said to have ended this day, having lasted from September 14th, or 253 days.

The small amount of the range of temperature in summer at Melville Island offers a very remarkable contrast to the great summer range at London. From May to October, the range at London is considerably more than at Melville Island, and in June double; but in the winter months, the range of temperature is far greater at Melville Island than at London. The monthly fluctuations in the aggregate are greater at London than at Melville Island, showing the fact that ours is indeed a very variable climate in respect to temperature; but, happily, the balance is on the warmth.

Digitized by Google

LIGHT AT MELVILLE ISLAND.

The 4th of November, being the last day that the sun would, independently of the effects of refraction, be seen above our horizon till the 8th of February—an interval of ninety-six days. But though we were not permitted to take a last farewell for at least three months of that cheering "orb of this great world both eye and soul"—we nevertheless felt that this day constituted an important and memorable epoch in our voyage. On November 11th the sun was seen from the mast-head. The 18th of November, at noon, Capella, a star of the first magnitude, was seen.

December 22nd. We had now reached the shortest day, and were surprised to find the quickness with which it had come upon us. The return of each successive day had always been very decidedly marked by a considerable twilight for some time about noon, that on the shortest day we were enabled to walk out very comfortably for nearly two hours. There was usually, in clear weather, a beautiful arch of bright red light overspreading the southern hemisphere for an hour or two before and after noon. Short as the day now was, if indeed any part could properly be called day, the reflection of light from the snow, occasionally aided by a bright moon, was at all times sufficient to prevent our experiencing, even under the most unfavourable circumstances, anything like the gloomy night which occurs in the more temperate regions. It will perhaps give the best idea of the sun's light afforded us on the shortest

Digitized by Google

day, to state that we could, at noon, read with tolerable ease the smallest type or print by holding the book directly towards the south. The type of the contents of our chapter was that which could be read.

On the 3rd of February the sun was seen from the Hecla's maintop, being the first time since the 11th of November, a period of eighty-four days, being twelve days less than the time of its remaining actually beneath the horizon, independently of atmospherical refraction.

On the 11th of February the sun's meridian altitude was 1°. Nothing could excel the beauty of the sky to the S.E. and S.W. at sunrise and sunset about this period—near the horizon a rich bluish purple, and a bright arch of deep red above, the one mingling imperceptibly with the other. The orange and lake tints painted the sky in the most beautiful manner.

On the 7th of February there was sufficient DAYLIGHT from eight o'clock till four, to enable us to perform any work outside the ship with great facility. What a rapid and surprising change! Parhelia or mock suns and halos were frequently observed.

On April the 7th at midnight there was light enough to read the thermometer with great ease, and this continued to be the case of perpetual light until the 2nd of September, or a period of 150 days.

And from the 4th of May to the 7th of August, a period of 96 days—the sun never set, but wheeled round day by day—a perpetual sun.

We cannot fail to perceive the evidences of the

Digitized by Google

universal law of Divine beneficence in the preponderance of the light over the dark. The sun never set for 96 days, but he was absent only 84, giving the majority of twelve days.

It would almost seem a senseless paradox to assert that the polar regions had a larger portion of light than the tropics. But such is not so remote from the truth as a casual thought might suggest; at any rate, there is a peculiar distribution of light in the polar regions.

The tropics enjoy the full blaze of light and heat in their intensity, but each of these elements undergo some modifications as they approach the polar regions. The light suffers great refraction, and produces some remarkable effects; the sun is seen when he is much below the horizon, and the same cause gives rise to the amazing length of twilight, so characteristic of these regions.

"When the sun loves to pause,
With so fond a delay;
That the night only draws
A thin veil o'er the day."

MOORE.

As these effects increase rapidly as we approach the pole, it is possible that absolute darkness is unknown there, and that there prevails a continuous twilight during the short time even that it is absolutely beyond the assigned limits of twilight declination or depression, but without even assuming this, or a single point beyond the demonstrated fact, we may consider the polar regions as the realms of light. Such being the apparent ordination of this agent, we may well suppose some specific purpose to be effected by the presence of such

Digitized by Google

a flood of light. The subject receives considerable interest from Professor Faraday's important researches on the relations of light and magnetism, and the great fact he established of the rotation of a ray of light by magnetic force, and his own conclusions that it did not seem impossible to him that the sun's rays might be found to originate the magnetic force of the earth, and that the atmosphere was the medium through which it was eliminated. Here we have the light, the magnetism, and the needle, and the electric lights.

AURORA BOREALIS AT LONDON.

Throughout the valuable work of Mr. Howard on the Climate of London, there are very few remarks, or notices even, of the appearance of the aurora borealis—in fact, they are only very casually adverted to. But in the winter of 1819-20 they are mentioned frequently.

1819.

Oct. 13th.—The aurora borealis is said to have appeared at night.

Oct. 17th.—Fine aurora borealis in the evening—observed at Tottenham by my friend William Philips.

AURORA AT MELVILLE ISLAND.

Captain Parry remarks that in no instance whatever, at Melville Island, did the aurora produce the slightest effect either on the gold leaf electrometer or on the magnetic needle. The most diligent and unwearied attention was given to this subject throughout the whole season, and many opportunities were afforded them of making the most delicate observations—but no effect.

1819.

Oct. 13th.—Aurora borealis seen, consisting of stationary white light, S.W.

Digitized by Google

1819.	1819.
Nov. 18th.—No aurora, but a brilliant meteor appeared in the west, larger than Venus, of a yellow flame, burning quietly, without sparks; when it ceased there was a luminous matter which gradually became extinct.	Nov. 14th-15th.—Aurora seen S.W. to S.E. The S.E. was the usual quarter in which the aurora most frequently appeared.
Dec. 14th.—Between 11 and 12 P.M., a fine exhibition of aurora borealis.	Dec. 14th.—Day beautifully serene and clear. Aurora S.W. to S.E.
1820.	1820.
Jan. 14th.—A brilliant aurora N.W. to N., and thermometer at night being at zero. The aurora was seen N.W. from London, S.E. from Melville Island, therefore it was situated between the two places, and seen at the respective bearings. It was a northern light at Melville Island.	Jan. 15th. — Was the only brilliant display of the aurora we had seen during the whole winter. It is impossible for words to give a description of the beauty, variety, and grandeur of this magnificent phenomenon. It was most vivid in S.E. and E.S.E., and had the appearance of being very near to us.

These instances of the aurora are given at London and Melville Island, because they evidently seem to denote something like a monthly recurrence about the same period. Mr. Howard's observations are most laconic; they are among the very few entries in his work. October 13th, 17th; November 18th; December 14th; January 14th. And when we consider their coinci-

Digitized by Google

dence with simultaneous exhibitions of the aurora at Melville Island, and allowing eight hours for the difference of time between the two places, some connection appears to exist between them, and that the aurora is often of considerable extent and of wide-spread action.

In respect to its assumed periodicity, why should we exclude the subtle spirit of electricity, when we perceive and note the obedience of its allied agent, heat, to the law of order? At any rate the examples I have given are, as far as a few instances go, in favour of such an idea. It may be objected that on the 18th November I have introduced a brilliant meteor instead of an aurora. But yet it may be well to advert to such a subject, as I am inclined to believe that some of the meteors, and especially those falling stars, whether in showers or singly, belong to the province of atmospheric electricity, and are connected and associated, in some degree, with the aurora, as far as electricity is concerned, for during the displays of the aurora, falling or shooting stars and meteors are very frequently mentioned as being seen.

And Mr. Howard's brilliant meteor was the periodic return of the auroral principle which took this form. Such, however, may be only a meteoric thought, and have no abiding power, and be excluded from the list. With even this excluded there remains the vestige of a fact and the presence of truth in the others.

The polar atmosphere is one of extreme interest in respect to its important properties of light, and the

Digitized by Google

connection of it with the directive power of the mariner's needle. The auroral, or electric lights, strengthen the analogy, and tend to confirm the idea that the atmosphere of these regions receives or acquires some specific powers developed by the action of light. What agent more mysterious, more subtle, more energetic than light in its high chemical action as displayed by photography? The rapid alterations of temperature in these high latitudes, and the constant action of light and the development of electricity, show that the three agents, or acting forces, are in full operation here, and effect some beneficial influence on a scale of considerable magnitude.

It is a beautiful subject of contemplation, and a source of pleasure, to spread a charm upon realms of darkness and direct the mind to cheerfulness. And what a coincidence of opinion obtains between Milton and Faraday upon the magnetic powers of light! How rapid are the actions of life and decay in the tropics; how slow is the one and how checked is the other in these regions! Here are displayed those conservative properties which make them the regions of purity—petrified by cold and encased in ice, chemical action is suspended. And the reeking and pestilential vapours of the earth, borne hence upon the wings of the wind, are spread aloft and condensed by the cold, the vapour is precipitated, and the gases, in their attenuated form and minute division, are exposed to the purifying influence and decomposing chemical action of almost continuous light, whose *actinic* beams here prevail in the upper

Digitized by Google

strata of the atmosphere. Here is developed the almost continuous play of the electric light; and is its power less than an electric or galvanic battery, whose intensity may be low, but its action constant? The polar regions are the ends of the earth's great battery, and where the most important processes are carried on for the benefit of the whole. Light, heat, and electricity, the three elements of nature, display peculiar properties in these regions. And it is well-known that snow-water contains a large amount of oxygen; but, oh, nature! thy volume is full of benefits and blessings too large for us to scan.

The summary report of the principal points of the climate and seasons at Melville Island is, in every respect, valuable and important. Inasmuch as the locality is peculiar, being beyond the verge of the habitable world, and from which the sun withdraws his cheering presence for the lengthened period of eighty-four days, and winter assumes its utmost rigour, whichever way the eye is turned it meets a picture calculated to impress upon the mind an idea of inanimate stillness — of that motionless torpor with which our feelings have nothing congenial; of anything, in short, but life. In the very silence there is a deadness with which a human spectator appears out of keeping. The presence of man seems an intrusion on the dreary solitude of this wintry desert, which even the native animals have for a while forsaken. Water is unknown in its natural state for eight months in the year, and

Digitized by Google

melting the snow or ice. But even when summer comes, and the sun wheels round in one continuous circle for ninety-six days without setting, yet with all this glorious light, how feeble is the heat. The mean temperature of the warmest month is only 42 degrees, presenting us with an example of the coldest known climate. It stands at the bottom of the list, and exhibits to us one of the extremes of the atmosphere, the mean temperature of the year being 2 degrees below zero, and without a recorded parallel. This privation of heat, the zero of the thermometer very significantly expresses, and is, indeed, most appropriate, for vegetation only languishes in its feeblest forms, and, in fact, almost dwindles down to nothing.

And yet, strange to say, these regions once bloomed with verdure, and had a rich and luxuriant vegetation, for the tomb of nature declares the fact, by the abundance of its organic remains, which are but the epitaphs of pre-existing races. True, it is the language of the dead, but it is intelligible enough to the most common observation; for here are found relics of plants and animals which no longer live in these regions, but are the inhabitants of warm and sunny climes *like* the tropics of the present day. These now frozen regions supported forests of dicotyledonous trees, as the abundance of fossil wood declares. But the important article of bituminous coal, of the oldest coal formation, is dispersed over several localities of these sterile regions.

If coal is the resulting product, as geologists state, of

Digitized by Google

pre-existing vegetation, how comes this coal intruded here, where a piece of wood is now unknown? What changes, vast and great, must have taken place in the temperature and climate of these regions! Captain Parry says, "We found innumerable fossils in the lime-stone, principally shells and madrepore, and on a hill abreast of the Hecla, at an elevation of 400 feet above the level of the sea, shells occurred in great abundance and perfection. Indeed, it was quite astonishing in looking at the numberless fossil animal remains occurring in the stones, to consider the countless myriads of shell-fish and marine insects which must once have existed on this shore. The fossil corals of the secondary lime-stones intimate that before, during, and after, the deposition of the coal formation, the waters of these seas were as warm as those of the equatorial seas," etc.

Whence can these things be, but in the vivifying warmth of the glorious sun-beams? But how can we ever dream of such a state amid these chilling scenes? Myriads of ages have long rolled away since such things were; but what once was, may be so again, and if the course of countless years has banished the sun, and capped these realms with snow and ice, so in ages yet to come, the sun may be ordered back, and shine again in all his glory upon these benighted realms, and clothe them with their wonted verdure, and man, or some being of intelligence, take possession of the land and all its treasures, which are now lodged in nature's storehouse, and are but as jewels in a casket, ready

Digitized by Google

to be opened and unfolded by Omnipotence Divine. For what are ten thousand ages, or millions of centuries, in His sight, of whom it is said, that "a thousand years are but as yesterday, seeing that is past as a watch in the night? Thou turnest man to destruction: again thou sayest, Return again, ye children of men!" The nations of the earth pass away, and the very land and country they inhabit may be as tenantless and as cheerless as Melville Island, which, in its turn, may rise up to greet the sun, and smile again with verdure.

Is this a fable, and beyond imagination?—when geologists even presume to tell us that such was once the state of happy England—that tropic suns have shined for ages, as our coal-fields testify; after that, icebergs and glaciers have capped the land. If such was the case, and Melville Island would seem almost to certify the fact, then England's fate may be again to change its scene to Melville's present state, and that become the England of its day. For can we think that all the buried treasures of the arctic regions—its gems, its metals, earths, and beds of coal—are all to lay as useless products in the womb of time? Why should we exempt them from the general plan? They wait alone the fiat of Divine Will to call them forth at his own appointed time; and, when he bids the sun revisit them again, these realms will teem with life and joy. Thus, all is over-ruled by climate, which is the essential element of organic life, and as Milton has truly and beautifully said—

"The sun is of this great world both soul and eye."

Digitized by Google

"Waft, waft, ye winds, his story,
And you, ye waters, roll,
Till like a sea of glory,
It spreads from pole to pole."

These enduring and sublime views of the power of the Deity, which strike the mind of every patient observer, connect, as it were, the phenomena of the earth with those more extensive arrangements presented to our intelligence in the planetary system, and in the grand design and structure of the universe itself.

On the return of the expedition to England the Government awarded the sum of £5000 to Captain Parry and the men, for having passed the 110° of west longitude, being the first portion of the Parliamentary grant for the discovery of the North-west Passage. They had accomplished half the distance between the two great oceans.

We cannot quit Melville Island, which has become a memorable spot in the history of the globe, and which this first voyage of Sir William Edward Parry brought into notice, without recording the ultimate result, by adopting the principle of this work, viz., Comparative and Analytical Research. This voyage achieved what had not heretofore been done; it was a great step in advance—in fact, it was the half-way, or central point of rendezvous of the arctic navigators.

Melville Island, by itself, would be an unknown place, but when associated with the exciting narratives of bold adventures, the story glows with warmth and light, and kindles up a kindred flame in every breast

Digitized by Google

who loves to know what man can do. For the poet says of Sir Hugh Willoughby, sent by Queen Elizabeth to discover the North-west passage; behold—

> "The Briton's fate who with first prow,
> For the North-west passage sought,
> Was with his ship, and helpless crew,
> Froze into statues; to the cordage glued,
> The sailor; and the pilot to the helm."
>
> THOMPSON.

Digitized by Google

CHAPTER IV.

1850, July — Her Majesty's Ship, the "Investigator," proceeds through Behring's Straits into the Polar Sea, along the Northern Coast of America, until the 30th of September, when they anchored for the Winter in the Prince of Wales' Straits, which communicated with the frozen waters of Melville Sound.—1851, July—The "Investigator" endeavours to reach Melville Sound, but is foiled by the terrific Polar Sea.—Providentially reach the "Bay of Mercy," and are frozen in on the very night of their arrival, 24th of September, and obtain, in these remote realms, a bountiful supply of Game during the whole Winter.—1852, April—Captain Mc Clure and a sledge party proceed to Melville Island, and the problem of the N.W. Passage solved, 24th April, 1852.—The Bay of Mercy remain frozen during all the Summer of 1852, and the Ship is fast bound in impenetrable masses of ice.—Another Winter passed in the Bay of Mercy.—Christmas Festivities, 1852. — 1853, January intensely cold.—1853, April 6th—The visit of merciful deliverance.—Lieutenant Pim and party, like an apparition or angelic vision, come from the "Resolute" with glad tidings of Relief. — The "Investigator" is left in the Bay of Mercy, and the crew transferred to the "Resolute," from thence to the "Phœnix" and Home.—The "Resolute" in her turn encounters dangers, and is abandoned, but drifts amid the Ice.—Is taken possession of by an American Whaler, and presented to Queen Victoria.—Results of the Voyage.—As to Climate.—Its present and former condition in accordance with Parry's statements.—Comparison of the Meteorological Tables of Captain Mc Clure at Mercy Bay, with the Tables from the Observatory at Port Louis.—Remarks and inferences on the Polar Atmosphere, and that of the Tropics. — Supplementary Observations by Lieut. Foster at Port Bowen, illustrative of the action of the barometer, humidity, etc., etc.—The white Fox and the black Raven.—Honourable Testimony to the British Arctic Navigators.

Digitized by Google

Digitized by Google

CHAPTER IV.

THE "INVESTIGATOR" AND THE "RESOLUTE."

"What cannot active government perform,
New moulding man?
Behold, at once the wonder done,
Exciting deeds of noblest fame."

THOMPSON.

THE Government, with great consideration, concerted and put into action the best means to search for and succour Sir John Franklin, whose spirit conceived the idea of Arctic research, and whose life was a sacrifice to his zeal and energy; and whose fate was probably much like that of the first explorer, Sir Hugh Willoughby. But it was in the search for Sir John Franklin that the North-West Passage was incidentally achieved.

July 30th, 1850. Her Majesty's ship, "Investigator," Captain Mc Clure, left the Pacific Ocean, and passed through Behring's Straits into the Polar Sea,

Digitized by Google

encumbered with ice, as to be hitherto considered impracticable for navigation.

September 30th, 1850. Was firmly frozen in the Prince of Wales' Strait, and Captain Mc Clure, entertaining a strong impression that the waters in which the "Investigator was then lying communicated with those of Barrow's Strait, and that the important question of a North-West Passage might now be solved, set out with a sledge and a few men, on October 21st, for the purpose of testing this conviction.

On October 26th, Captain Mc Clure and his party reached Point Russel, and ascended an elevation of about 600 feet, commanding an extensive view; and had the gratification of finding that their arduous and fatiguing journey had not been in vain, for beneath them lay the frozen waters of Melville Sound, proving, beyond doubt, that a North-West Passage from the Atlantic to the Pacific existed. Captain Mc Clure reached the ship again on October 31st, and remained frozen in until July 14th, 1851, when the ice broke up, and every effort was made to get into Melville Sound to the westward along Baring's Land, and accomplished the terrific passage of that terrible Polar Sea; but seeing no possibility of getting down Barrow's Straits, they were obliged to anchor in a most safe and excellent harbour, which, in grateful remembrance of the many perils they had escaped during the terrible passage of the Polar Sea, was named

"THE BAY OF MERCY."

Digitized by Google

Thus finally terminated, on September 24th, 1851, this short season's operation, having been actually only five entire days under weigh. They were frozen in the first night, and were thus fixed in their winter quarters. Latitude 74° 6′ north; Longitude 118° 15′ west.

As there appeared much game in the vicinity, and the weather continued mild, shooting parties were established in different directions, between the 9th and 23rd of October, and we obtained 9 deer, having from two to three inches of fat, 53 hares, and 44 ptarmigans, all in fine condition. In consequence of our favoured position, the crew were enabled to ramble over the hills almost daily during the whole winter, in quest of game, and their exertions happily supplied a fresh meal of venison three times a fortnight, with the exception of about *three weeks in January*, when it was *too dark* for shooting. The small game, such as ptarmigan and hares, being scarce, were allowed to be retained as private property by the sportsmen. This healthy and exhilarating exercise kept us all well and in excellent spirits during the tedious winter, so that by April 1st we had 1,000 lbs. of venison hanging at the yard-arms.

All wearing a fair aspect and being desirous of visiting Melville Island, with the hope of meeting an officer there, with whom arrangements might be made in case any accident should occur, Captain Mc Clure, with a sledge party, proceeded on April 11th, 1852, and reached Melville Island on the 28th, and deposited a

Digitized by Google

notice of their visit under the same cairn where Lieut. Mc Clinlock left one last year, upon a large fragment of sandstone bearing this inscription—

"His Britannic Majesty's ships, 'Hecla' and 'Griper,' commanders Parry and Lyddon, wintered in the adjacent harbour during the winter of 1819-20.

"A. FISHER, *Sculpsit.*"

Thus, Captain Mc Clure, coming round by the Pacific from the westward, through Behring Straits, and trending along the northern coast of America, reached Melville Island, and at the very tablet recording Parry's residence, Captain Mc Clure deposited the testimony of his visit, being 33 years after Parry's discovery of it.

Thus by Captain Mc Clure was completed the last link in the chain of discovery, and demonstrated the existence, and traced the course, of that connexion between the two oceans, which, under the name of the North-West Passage, has so long been the object of perilous search, and deep interest to the nations of the civilized world.

In the discovery of the double passage, the honour is to be equally divided between Parry and Mc Clure. Parry from the eastward penetrated to Melville Island. 110° west longitude, and obtained the first Parliamentary grant of £5,000. Captain Mc Clure from the westward reached the same spot, and completed the circle, and received £10,000 Parliamentary grant.

Captain Mc Clure left Melville Island on April 30th,

Digitized by Google

and returned to the "Investigator," in Mercy Bay, on May 8th, having travelled the entire way upon the flat ice.

The spring and summer of 1852 were cold. Even on August 20th the temperature fell to 27°, and Mercy Bay was completely frozen over, so that the whole aspect was most cheerless; the young ice was two and a half inches thick. Indeed, the summer was gone, for the uplands were all covered with snow, the wild fowl had departed, and the flowers which gave a cheerful variety to this bleak land, were all withered. The very season might be considered as one long sunless day, as since the latter end of May that luminary had been scarcely visible, or his influence felt.

On September 24th, the sails were unbent, and preparations commenced for again housing in for winter. This is the anniversary of our arrival, and the contrast is remarkable. We entered the Bay, not a particle of ice being in it, and with the temperature at 33°; but to-day the thermometer stands at 2°, with ice that has never moved, and every indication of a severe winter. And thus we were closed up again for another winter in Mercy Bay.

In November, herds of deer came down, sometimes as many as ninety at a time; these animals do not migrate to the south, but exist upon the scanty herbage, especially the dwarf willow. Hares and ptarmigans were abundant.

Digitized by Google

Christmas Festivities, 1852, on board the "Investigator" in the Bay of Mercy.

"As it was hoped to be our last, the crew were determined to make it memorable, and their exertions were completely successful; each mess was gaily illuminated and decorated with original paintings by our lower-deck artists, exhibiting the ship in her perilous positions during the transit of the Polar Sea. But the grand features of the day were the enormous plum-puddings, some weighing 26 lbs., haunches of venison, roasted hares, hare soup, ptarmigan, and sea pies. Such dainties, in such profusion, I should imagine never before graced a ship's lower deck; any stranger to have witnessed this scene could but faintly imagine that he saw a crew which had passed upwards of *two years* in these dreary regions, and enjoying such excellent health; so joyful, so happy, indeed, such a mirthful assemblage, under any circumstances, would be most gratifying. But in this lonely situation I could not but feel," says Captain Mc Clure, "deeply impressed, as I contemplated the gay and plenteous sight, with the many and great mercies which a kind and beneficent Providence had extended towards us, to whom alone is due the heartfelt praises and thanksgivings of all for the great blessings which we have hitherto experienced in positions the most desolate which can be conceived."

"1853. January. Excessively cold, showing a mean

Digitized by Google

temperature of 44° below zero. On the 9th of January it fell to 69° below zero, and for twenty-four hours actually averaged 62°; no former experience shows so low a temperature. For one entire week the temperature was never above 40° below zero, the wind being about S.S.W. from which quarter we had always the coldest weather; and when the wind comes directly from the north, or from off the Polar Sea, we had the warmest weather.

"March 21st. Weather beautiful, the thermometer rising on to 40°, a sudden and delightful change, so that the extreme severity of the winter is over. To this period we have not lost an individual of our crew, either by accident or disease. I can attribute our most excellent salutary state to the bountiful supply of game which a merciful Providence has aided us with, and likewise to the excellence of all species of our provisions, particularly the superior quality of the lime juice, which, as an anti-scorbutic, has proved most inestimable: with the preserved meats supplied by Messrs. Gamble, which rank in the very highest scale of excellence; and, moreover, for that most invaluable vegetable, the preserved potato, manufactured by Edwards.

"I forward a monthly mean of the Meteorological Journal, which has been registered every alternate hour by the respective officers of the watches, and carefully arranged and tabulated by Mr. Court, which complete tables will, I hope, prove interesting."

This was the language and statement in the beginning of April, 1853, while still shut up in Mercy Bay, which

Digitized by Google

was a sweet and suggestive name and most appropriate; but there was another mercy now at hand—a messenger—on an angelic mission, appeared in sight; it seemed but as a spectre to mock the vision.

Lieutenant Pim and a party of seamen arrived, on the 6th of April, from Melville Island, and the officers and men of the "Investigator" were raised from a state of despondency to the height of exultation and delight. The sick leapt out of their beds with joy. And how came they here on this visit of mercy? Why, the Government had dispatched the "Resolute" in the command of Captain Kellett, to proceed, if possible, from the westward to Melville Island, in order to ascertain if any communications or tidings were there; and Captain Kellett, while wintering in 1852-53 in the neighbourhood, discovered the record left by Captain Mc Clure the preceding year: and he promptly sent to his relief the expedition under Lieutenant Pim. It is impossible to overrate or exaggerate the importance of this succour, and without this timely assistance it is doubtful whether Mc Clure and his hardy crew would not have shared the fate of Sir John Franklin.

Captain Mc Clure, his officers, and crew, joined the "Resolute" on June 21st, and left the "Investigator," as a relic, in Mercy Bay, and a monument of British enterprise. But they were frozen in again, September, 1853, south west of Cape Cockburn, and remained there until the 10th of April, 1854, when they ran down Baffin's Bay to Disco in Greenland, and were transferred to the "Phœnix," Captain Inglefield, and

Digitized by Google

arrived at Cork, 30th of September, 1853, having been absent four years and eight months.

Forgive this episode. The long-sought-for problem has at length been solved by this country, and another ray added to the maritime glory of the British Empire.

The successful issue of this daring undertaking has served to bring forward some of the best officers and bravest seamen in the British Navy, and added greatly to the lustre of that service of which our nation is so proud. The advancement of natural science, and our extension of the knowledge of the globe, appear to have been the sole incentives of these expeditions, sullied by no lust of conquest or selfish views, and must ever be considered among the most disinterested of national undertakings.

The "Resolute" was abandoned in consequence of her perilous situation, in 1854. She was discovered and rescued from the ice by an American whaling ship. She was purchased for £8000, and refitted by the American government for presentation to the Queen of England.

December 12th, 1856. The "Resolute" arrived at Spithead, and, on the 16th of that month, Her most Gracious Majesty Queen Victoria went on board, and received the vessel as a gift from the hands of Captain Hartstein, as a memento of the good will and friendship of our transatlantic kinsmen.

Thus the "Resolute" proved true to her name, and pourtrayed her character and qualities, with some

Digitized by Google

touch of romantic incidents, and completes the narrative of the discovery of the North-West Passage by the "Investigator"—appropriately so named. How well both harmonize with their exploits—their names are expressive of their character and deeds! Thus, Investigation and Resolution combined, achieved the triumph, and obtained the fame, for Britain's great and glorious name!

There are many points of accordance between the statements of Parry and Mc Clure, and perfectly so in respect to the climate, so that, from their accurate and beautiful registers, we are in possession of a complete collection of facts relative to the climate of the arctic regions. And as we cannot have any better authority, or are likely to obtain, for a series of years, any further contributions in this respect, we are desirous of availing ourselves of the valuable materials they have so ably and so industriously collected, not only in respect to the present state of the climate, but their conjoint testimony as to its previous condition.

I have before asserted, in speaking of Melville Island, that the organic remains unequivocally declared a warmer period to have existed. Captain Mc Clure, in wintering in Prince of Wales' Strait, Baring's Land, latitude 74° north, longitude 122° west, says: "In our rambles we made a most interesting discovery of a range of hills, composed almost entirely of one complete mass of wood in every stage, from a petrifaction to a log fit for firewood. Many large trees were among it; but, in endeavouring to exhume them, were found

Digitized by Google

too much decayed to stand the removal; the largest piece we were enabled to bring away, being 3 ft. 10 in. in girth, and 7 ft. long. They were found at an elevation of 300 ft. above the beach.

Not only has he completed the link in the chain of the North-West Passage, but by the discovery of these "wood hills" has added an important fact to the history of the atmosphere, by demonstrating the prevalence of a warm period, throughout the entire circle or zone of the arctic regions, at some distant era.

Throughout the whole of northern Asia there are strewed the bones of elephants, and even elephants themselves, and Siberia abounds with them; and "wood hills" are found in its most sterile and northern portions, far remote from any existing vegetation. Ivory is found in the frozen lands of the arctic regions, and the bones are piled in heaps. The N.W. coast of America, at Kotzebue Sound, is a vast cemetery.

Captain Mc Clure has added the "wood hills" as the connecting link between the N.W. and the N.E. coast of America. Greenland has coal mines, and Iceland its fossil wood; so that the circuit of the globe in this region is complete, and uniform, and decisive in its testimony, that some general law or action of the atmosphere prevailed in these regions in times past.

Such inquiries as to how or by what means exceeds the ken of human comprehension. But some vast and

Digitized by Google

mysterious agency can alone have accomplished such mighty results. Climate overrules all things at present, for climate determines the productions. Geological conditions do not. We have strong and indisputable facts which indicate a widely different state of temperature in one complete circuit of the globe. And if the present mean temperature of it be assumed as 0, and the antecedent state as 60°, there is a difference of 60° round the whole arctic circle—or the circumference of the globe in that region. If the opinions I have advanced be correct as to the definite quantity of heat, and its power or property of transfer, from one area to another, it follows, as a natural consequence, if the condition and laws of temperature were formerly the same as they now are, that the large reduction of temperature of the arctic regions must have increased or augmented the temperature of some other area, to the extent of 60°, which is a large quantity.

The theoretical consideration of this amazing change of climate, belongs to meteorology, although it enters largely into the hypothetical views of geologists, in fact, it is the key to the whole phenomena, for heat is the great element of nature.

I have placed the tables on pages 96 and 97, for the purpose of comparison, thought, and reflection. The first embodies the result of accurate observation made with the best instruments, and the utmost attention and fidelity. I have given that of the "Investigator," in the Bay of Mercy, having previously supplied that from Melville Island: and likewise compared them with

Digitized by Google

the refined and delicately minute register of Lieutenant Foster at Port Bowen, and Captain Parry. They all agree most surprisingly, we therefore have more than three years' tables of the latitude of 74° North.

The observations from Port Louis comprises 50,000 observations by J. A. Lloyd, over a period of three years.

The facts being furnished by the most eminent authorities are of the greatest value, and they enable us to enter on the investigation of the polar atmosphere with some degree of confidence. And the very first month, January, presents us with a state and condition which it is not very easy to comprehend.

At 74° N.	Mean Barometer	29·84.	Mean Temperature		27°—
At 20° S.	,,	29·85.	,,		82°.
		·01.			109°.

Here is a very surprising and almost startling case, the barometers being the same, while the mean temperature of the two places differ 109°. Such a wide disparity, such an immense departure from what we might expect, requires some inquiry. The introduction to the Greenwich Observations informs us that a cubic foot of air, saturated with moisture, at 27°, weighs 630 grains, and a cubic foot of air at 80° weighs 503 grains.

Digitized by Google

H.M.S. INVESTIGATOR IN THE BAY OF MERCY LATITUDE 74° NORTH. 118° WEST LONGITUDE.

BAROMETER.		MONTH.	THERMOMETER.	
RANGE.	MEAN.		RANGE.	MEAN.
30·60 29·28	29·84	January ,,	+ 8 —51	27—
31·00 29·07	29·77	February ,,	— 1 —47	25—
31·00 29·41	30·08	March ,,	+ 5 —52	28—
30·43 29·52	30·16	April ,,	+31 —38	1—
30 25 29·60	29·98	May ,,	+37 —25	10+
30·10 29·43	29·75	June ,,	51 11	31+
30·00 29·37	29·74	July ,,	52 30	36+
30·17 29·40	29·81	August ,,	52 19	33+
30·10 29·07	29·78	September ,,	+38 — 4	20+
30·30 29·44	29·98	October ,,	+16 —33	5—
30·68 29·46	29·97	November ,,	+ 9 —43	16—
30·67 28·97	29·94	December ,,	— 4 —48	26—
29·90		Mean of the Year		0°

Digitized by Google

OBSERVATORY, PORT LOUIS, MAURITIUS, LATITUDE, 20° SOUTH.

BAROMETER.		MONTH.	THERMOMETER.	
RANGE.	MEAN.		RANGE.	MEAN.
30·18 29·13	29·85	January ,,	86 80	82
30·21 29·64	29·89	February ,,	83 80	81
30·22 29·99	30·10	March ,,	85 80	82
30·22 30·00	30·06	April ,,	84 79	82
30·38 30·11	30·20	May ,,	81 76	77
30·44 30·08	30·23	June ,,	80 73	76
30·44 30·11	30·25	July ,,	76 70	73
30·44 30·17	30·29	August ,,	76 72	74
30·44 30·18	30·30	September ,,	77 73	75
30·40 30·15	30·22	October ,,	78 75	76
30·45 30·16	30·21	November ,,	81 74	79
30·26 30·04	30·09	December ,,	83 80	81
30·11		Mean of the Year		78

Digitized by Google

It is evident, upon the very first impression, that the density of the air in the polar regions, compared with that of the tropics, must, if both columns have the same *relative* weights, and continue to preserve the same difference at equal altitudes—that the polar atmosphere must be of very much lower height than the light and rarefied air of the tropics.

We have the indisputable fact that both weigh absolutely the same at the base. Are they, then, of the same height? At 18,692 feet altitude the barometer stands at 15 inches in the tropics, and it would be only at 11 inches in the polar circle. The atmosphere within the polar circle would be at least ten miles less in altitude than the tropical, and if we consider likewise the circumstance that the barometer sometimes falls to 28 inches in the polar regions, that would make a considerable subtraction from the height again, and reduce it to small dimensions, and leave the tropic atmosphere towering very far indeed above it. And in this case, the atmosphere at the summit would not present an even surface, or be of an equal height, in the different regions of the globe. It is calculated to be forty-eight miles in height in the tropics; it will be only about thirty-six in the polar regions.

But I have adverted only to the first point of the tables, viz., January, which gives the same mean barometer at both places; but, if we take the month of September for comparison, we find the case altered.

Digitized by Google

At 20° S.	Mean Barometer	30·30.	Mean Temperature	75°.
At 74° N.	,,	29·78.	,,	20°.
		·52.		55°.

A very striking and remarkable difference still obtains. The barometer in the warmer region of the tropics, where the air is lighter, presents the higher barometer by absolutely half-an-inch, being quite the reverse of what it should be by our views of it.

These speculative inquiries are not so useless or barren as might be supposed, for they lie at the root of all our opinions in respect to the general action of the barometer. They involve questions of importance, and from the total want of accordance between the barometer and thermometer, it would seem to be most unnecessary to make any correction for temperature in the barometric observations. The absolute reading is the true one, and more accordant to nature than the applied corrections.

If we assume the atmosphere to be of one uniform height in every region of the globe, how are we to reconcile it with the different weights of the same bulk of air? Two columns of air having the same height, and being of the same absolute weight at the base, must have the same amount of heat in the columns, although the heat may be very differently distributed in the columns. The temperature at the base of the two columns may differ 120°, but a principle of compensation may exist in both; the warmer or tropical column may decrease rapidly in temperature as it ascends and leaves the warm and heated earth; the colder or polar column

561414

Digitized by Google

may decrease but little, and at no very inconsiderable height may become relatively, if not absolutely, warmer than at the base.

The following statement appears in the most scientific works:

"The air in the higher regions of the atmosphere is much cooler than below; as it ascends from the earth it expands, and in expanding *its capacity for heat is increased*, it therefore cools itself as well as the surrounding bodies. The Andes, placed almost under the equator, rise in the midst of burning sands: about the middle height is a pleasant and mild climate; but the summits are covered with eternal snows; and these ranges of temperature are always distinct. The hot winds from below, if they ascend, become cooled in consequence of expansion; and the cold air, if by any force of the blast it is driven downward, is condensed and rendered warmer as it descends." — *Brande's Manual*, page 65.

This is to a certain degree true, for if a cubic foot of air, at the temperature of 80 degrees, becomes two cubic feet by diminished pressure at about 18,000 feet altitude, of course, as the air is divided or expanded into two volumes, its heat is likewise divided into two parts or half; and the temperature of the double mass is only half that of the original volume. Its temperature is divided. There is no chemical law or capacity for heat involved in it—it is a plain, obvious, and mechanical division of heat, accompanying the mechanical expansion of the air from diminished pressure. And

Digitized by Google

this important principle will produce widely different effects in the tropics and polar regions, and tend materially and quickly to equalize the temperature of the upper portions of the atmosphere. But there is likewise another consideration which we have adverted to and adopted in the extract from Professor Faraday on the magnetic condition of the atmosphere (vide page 36, etc., in our 2nd Chapter). If we are authorized to receive such statements, then the upper regions of the polar atmosphere most beautifully illustrate his theory, and the opinions I am desirous of advocating receive the sanction of his authority.

From the general concurrence of the facts and opinions, there is every reason to assume that the upper and loftier regions of the atmosphere within the polar circles, are absolutely warmer than the lower, and that the order of the position of the strata of the atmosphere is reversed at the poles to that of the tropics. There is almost a continuous play of twilight around the pole, for the sun is never long below the twilight degree of declination—the sun is only for a very short time more than 23° below the horizon of the pole. But in the tropics the sun descends every twenty-four hours to 90° below the horizon. And when we add the amazing refractive power of the polar atmosphere, it becomes a probable opinion, that its upper regions, being almost continually illumined, must partake in some degree of the heating power, although slight, but the continued action must produce some effect. And if light has a magnetic power, here then is its seat. The electric,

Digitized by Google

chemical, and thermal condition of the upper regions of the polar atmosphere is everywhere as different from that of the tropics, as much as the base of the atmosphere of the two regions differ. The conditions are reversed.

But this, some will say, is absurd, or at least hypothetical; but we have an analogy in the waters of the ocean. In the tropics the warm and tepid waters float upon the surface; but in the polar regions its surface is cold and frozen, or at any rate of icy temperature, but the bottom water is warmer and the abode of life. It is protected by the column above; it has no evaporation, no radiation; it is free from atmospheric influence; and by the special law by which Infinite wisdom has fixed the point of the greatest density of water at 40° Fahrenheit, the heaviest water sinks to the bottom, so that the warm water of 40° Fahrenheit reposes on the bed of the ocean, in every region of the globe alike. The depths of the ocean are not below that temperature at the pole itself—although mountains of ice float upon its surface.

We are not warranted in relying too much on analogies, but we are warranted in believing that the same power that reverses the order of position of the waters of the ocean, as regards its temperature, may likewise, by any mode or modes unknown to us, reverse the order of the aërial ocean; and warmer air may occupy the loftier realms of the polar skies than in the tropics, or else the height of the columns cannot be equal, with such amazing difference of temperature.

Digitized by Google

Professor Daniell, in his able and elegant work on Meteorology, says:—"The elasticity of the air, as measured by the barometer, remaining the same, its specific gravity is very much greater at the poles than the equator; hence the atmospheric column must be proportionally shorter at the poles, and this heavier fluid must press upon and displace the lighter, and produce a current from the poles to the equator.

"But the difference of gravity becomes less as we ascend, and at a certain point is neutralized; while, on the other hand, the elasticity, which is equal at the surface, varies with the height, and the barometer stands higher at equal elevations in the equatorial than in the polar column. This disproportion increases with the elevation, and, at some definite height, must more than compensate the unequal density of the lower strata, and occasions a counter flux from the equator to the poles, so that, at a height of 20,000 feet, the barometer at the poles would be 11 inches, but 13 inches at the equator, the temperature being 82° below zero at the poles, while the temperature at the same height in the tropics would be 12° above zero."

It is neither pleasant nor reputable to differ from so great an authority, and the reader must adopt the opinion most consonant to the general facts.

There are some other points which deserve a notice. The mean barometer in the polar regions is 29·89 inches. This weight gives it no preponderance or power over that of the more temperate climates; for, although the air is extremely cold and dense, yet this

Digitized by Google

density is only partial, and is restrained by the aggregate amount equalizing it, so that it has no power or tendency to rush down upon the lighter air of the warmer regions, for the balance is held equally, and the impetuous and chilling power is kept at bay, and preserved in general quiescence within its own territory. By this arrangement the temperature is greatly limited, for, as the winds are caused by barometric pressure, if the polar region had a higher barometer, there would be a perpetual, or more frequent north wind.

Another extremely interesting illustration may be seen in the table of Mauritius, which gives a mean barometer of 30·11 inches to its warmer and sunny climate. It is an anomaly to have the greater weight of atmosphere amid the lighter air of the tropics. But here, again, we are called upon to admire and adore the Almighty Being, whose infinite wisdom has arranged every department of nature in a manner so wonderfully adapted to every required exigency as to surpass all the intellects of men fully to discern.

If from the testimony of the barometer we were called upon to assume a warmer air above in the polar circle, we are here constrained, by parity of reason, to assume a colder portion of air above in this particular region. For it is a particular region which envelopes or encircles the margin of the tropics, and encloses them as with a lofty wall of air. On the verge of either tropics there is an atmospheric belt or zone of high pressure — a hot region, a dry region of peculiar

Digitized by Google

character—extending 8° or 10° of latitude, and of equal extent with the zodiac, and perhaps it might be called the zodiacal region, as being parallel to it.

Now this amazing belt or zone of high pressure (mean barometer 30·11) stands as a lofty mountain ridge of air between the tropics and the temperate climates. And what is the extraordinary result of this ordination? Why, as streams flow down equally on either side the mountains, so from this mighty zone of air of high pressure, currents of wind fly off or are impelled from either side. From hence proceeds the cool refreshing trade winds of the tropics, while from the other side, the grateful, soft, and balmy breezes blow mostly into the cooler regions, as the S.W. winds of our own climate. Hence a double benefit arises—two blessings at one time, of north and south winds, hot and cold, by one act, and each where needed. How kind and gracious! How this high pressure is permanently maintained does not appear; we must rest content at present with the fact, and with a grateful estimation of its immense effects and its world-wide benefits.

There are, likewise, some states of barometer in our own climate which have not been satisfactorily accounted for, as the extremely low barometer occasionally in the winter months. Are we to suppose in these cases that a larger volume of warm air and vapour prevails, or is present in the atmosphere then than in the summer? For warm air, charged with vapour, is specifically lighter than cold air, and, consequently we assume the barometer to be lower with such. How comes,

Digitized by Google

then, our lowest barometer to be in the winter months? Are we disposed to admit the same principle we have assumed to prevail in the polar regions—viz., that a larger mass or volume of warmer air exists above? Such appears a difficult assumption, and hard to reconcile with our preconceived opinions. But our low winter barometer, the polar regions, and the ultra tropical zone of high pressure, all are referrible to one and the same cause—viz., volumes or beds of air of different temperatures at various altitudes.

It is true, some may be disposed to refer the whole to aërial waves, or tides of high and low columns of air, like those of the waters of the ocean. No one, however, knows, or has any means of knowing, anything about the lofty summits of the atmosphere. We can only reason upon what we know, and from what we see, and we have abundant evidence of [illegible] currents of air at different altitudes, and beds of ai possessing varying temperatures, and these seem adequate to effect the changes we experience and observe in the instruments.

In connection with this subject, I cannot do bette than add a few remarks from the observations of Lieut Foster, at Port Bowen, from Captain Parry's Second Voyage. Lieut. Foster was a first-rate observer, and was especially furnished with the best instruments. He was indefatigable, and received the gold Copley Medal of the Royal Society of London, bearing the inscription of "Optissima," as an estimation of the value of hi labours and observations, and was, moreover, promote

Digitized by Google

Commander to the "Chanticleer," on a voyage of research :—

"Particular attention was paid to the barometer during this winter, to which much encouragement was given by the excellence of the instruments furnished to us under the superintendence of Mr. Daniell. The most rigid attention during several months discovered a diurnal or horary occillation amounting only to ten thousand parts of an inch. The times of maximum and minimum appeared decidedly to lean to four and ten, and to follow a law directly the reverse of that found to obtain in temperate climates; the column being highest at four and lowest at ten o'clock both A. M. and P. M. The barometer did not appear before-hand to indicate the changes of the weather with any degree of certainty. Alterations in the column more frequently accompany than precede the visible changes of weather in these regions.

"During this, as in all the preceding winters, we failed to obtain any hygrometrical expression for the state of the atmosphere, though we were furnished with the most excellent hygrometers of Professor Daniell. Below a temperature of 6° above zero we failed to obtain any deposit of vapour. That the atmosphere was extremely dry, was evident, for a worn whale line, sixteen hundred and fourteen feet in length, being stretched quite tight between the 'Hecla' and the shore, for the purpose of marking the road in dark weather or snow drifts, relaxed so much during the cold weather, that forty-nine feet were hauled in from time to time to keep it

Digitized by Google

in its place upon the snow pillars upon which it was supported.

"Although we could not detect the presence of any moisture in the air, yet some evaporation was going on, because a brass instrument entirely sheltered from the wind, may one day be seen covered with numberless minute snow crystals adhering firmly to the metal, and the next perfectly clean and bright without any possible assistance from wind or artificial heat."

There was no want of well defined clouds this winter of the kind called cirro stratus. The depth of snow which fell during the winter was only about four inches. The crystals were extremely minute. The weight of a cubic foot of this fine snow dug out of a drift was thirty pounds.

The ice formed upon the canals by which the ships had entered, increased in the following ratio :—

In November	it was	30	inches	in thickness.
In December	,,	38	,,	
In January	,,	45	,,	
In February	,,	55	,,	
In March	,,	73	,,	
In April	,,	82	,,	
In May	,,	86	,,	

Although the effect of the season in changing the colour is well known, I will merely mention that of *Canis Lagopus*. One or two foxes were killed and four were caught in traps during the winter. The colour of one of these animals, which lived for some time on board the "Fury," and became tolerably tame,

Digitized by Google

was nearly *pure white* till the month of May, when he shed his winter coat and became of his usual chocolate colour.

Only three hares *(Lepus Variabilis)* were killed, weighing from six to eight pounds. Their fur was extremely thick, soft, *and of the most beautiful whiteness imaginable.* In the spring they changed to brown.

The raven *(Corvus Corax)*, was found in the most northern parts of the arctic regions, and a pair of them took up their winter residence in the high cliffs of Port Bowen, and occasionally approached the ships for food. Winter produced no effect whatever on their dark and glossy plumage; their black was permanent and enduring, and afforded a striking contrast of colour to all around; except that they were frequently observed to have a white ring round the neck, caused by the accumulated encrustments of the vapour of their breath freezing on their plumage, and giving them a very singular appearance, thus decked with a necklace of ice.

These intruding notes forgive. There was little life in this desolate and unproductive place, and the temperature of the artic fox was 116°. The ptarmigan only 102°. The temperature of the birds being below that of the animal, which is contrary to the general law.

And we cannot more becomingly take leave of these British navigators in the polar regions, than in the honourable testimony that Captain Parry renders to the memory of the earlier voyagers, whose works and

Digitized by Google

labours are the productions of men of no common stamp, who have described and pourtrayed with faithfulness and accuracy every appearance of nature, and with such simplicity, as unequivocally bears the impress of truth. And their observations and researches are among the standards of scientific excellence. But one cannot less admire the intrepidity, perseverance, and skill, with which they encountered the greatest difficulties, and by undaunted courage, and Herculean labours, overcame them. They, indeed, claim our highest admiration and respect, and deserve to be ranked among the noblest of our countrymen.

Persevering in difficulty, unappalled by danger, and patient under distress, they scarcely ever use the language of complaint, much less of despair; and sometimes, when all human hope seems at its lowest ebb, they furnish the most beautiful examples of that firm reliance on a merciful and superintending Providence, which is the only rational source of true fortitude in man. We may well exclaim with all the enthusiasm of Purchas, "How shall I admire your heroicke courage, ye marine worthies, beyond all names of worthiness."

Digitized by Google

CHAPTER V.

The year 1826 at London.—Table showing the Recurring Periods.—The Wind a great element of the Weather; its accordance with the Instruments.—Madeira, type of Zodiacal region, a responding area with England.—Table of the year 1826 at Madeira, and its Recurring Periods.—Mean Barometer and temperature at London and Madeira.—The Orange and the Camellia types of a Winter Climate.—Reciprocating action between Madeira and London.—Thermometer at Fort Franklin, 1826, and its Recurring Periods —Table of year 1834, by Mr. Whistlecraft, and its Recurring Periods.—Table of the year 1834, at Newfoundland, and its Recurring Periods.—Climate of Newfoundland.—Newfoundland and England Responding and Corresponding Atmospheric Areas.—Magnetical and Meteorological Observations at the Royal Observatory, Greenwich, for the year 1845.—Table of year 1845, and its Recurring Periods.—Mean Barometer and Thermometer and their Recurring Periods. — Extraordinary Observations on the Winter of 1845, and its Critical Days.—Mean Barometer and Thermometer of the Months of 1845.—The Recurring Periods of the Dew Point.—The Recurring Periods of the Declination Magnet, and the Recurring Periods of the Vertical Force Magnet. — Observations on the Declination of the Magnetic Needle, and on the Electricity of the Atmosphere.—Conclusion of the Evidence adduced in favour of the Recurring Monthly Periods of the Atmosphere.

Digitized by Google

Digitized by Google

CHAPTER V.

THE glorious summer of 1826, in England, was distinguished by glowing and continued heat, and a small amount of rain—eleven inches from March to August inclusive—a period of six months. The harvest was extremely early, the wheat being cut and finished almost in July.

Some inconvenience was experienced, and an unusual number of complaints made from week to week of wells and ponds dry, cattle suffering from the prolonged and serious drought, as it was termed. Famine and pestilence were among the unbecoming prognostications, and the tropical temperature was not spoken of with propriety, nor received with favour. The moors were on fire, sheep walks destroyed, the meadows were dusty, and hay was a short crop.

The temperature of the open air was 125°, and some persons lost their lives in the hay fields from the power of the sun. Some severe thunder-storms were the attendants of the heat; and the rattling hail and ice of

Digitized by Google

three inches in circumference, smashed several hundred thousand squares of glass in the neighbourhood of London, and the heavy downfall of rain swept away every little impediment, cleaned the streets of their filth, and refreshed the fields with life. But this catalogue of magnified little ills was of short duration, and the impatient spirit of undue and murmuring complaint subsided when the rains of autumn came. The harvest was good, and the product was great, and the earth yielded its precious gifts in abundance of many articles, and a deficiency only in a few. We shall have occasion to see how little reason we have to complain of our climate, when we presently speak of droughts that are real.

I have introduced the year 1826, partly on account of its being the associate or partner of 1845, in respect to the lunar cycle of nineteen years, in which the moon returns again to the same place within two hours of the same time; and the seasons have been supposed by many to do so likewise, thus giving an idea of a recurring period of nineteen years.

I have departed from the mode I first adopted in the tabular epitome of each year, and have arranged it in the order of time, giving that the precedence, as being more natural, and as exhibiting the changes and conditions as they occurred.

Digitized by Google

THE YEAR 1826, FROM HOWARD'S "CLIMATE OF LONDON"—THE DAYS OF HIGHEST AND LOWEST BAROMETER AND THERMOMETER, AND THEIR RECURRING PERIODS, AND THE DIRECTION OF THE WIND.

BAROM-ETER.	WIND.	DAY.	MONTH.	DAY.	WIND.	THER	ANALYSIS. BAROMETER.	ANALYSIS. THERMOM.
29·70—	N.W.	1	Jan.	1+	N.W.	47	Jan. 17.	Jan. 1.
30·65+	E.	17	,,	14—	W.N.W.	10	Feb. 16.	Feb. 3.
29·34—	S.	16	Feb.	3+	S.	58		
30·54+	N.W.	26	,,	9—	N.E.	20	March 11.	Feb. 9.
							April 12.	March 10.
30·57+	E.	11	March	10+	S.E.	70	May 12.	
29·43—	N.E.	23	,,	17—	N.W.	24		March 17.
30·44+	N.W.	1	April	15+	N.W.	70	April 1.	April 15.
29 07—	N.W.	12	,,	29—	N.W.	25	May 1.	
							June 1.	
30·37+	N.W.	1-12	May	8—	N.E.	28		June 3.
29·68—	E.S.E.	25	,,	18+	S.E.	76		July 3.
							June 20.	
29·90—	N.E.	1	June	3—	N.W.	42	July 21.	
30·54+	N.E.	20	,,	27+	S.E.	92	Aug. 23.	June 27.
								July 26.
29·60	S.W	21	July	3+	E.	89		
30·40+	N.E.	26	,,	26—	N.E.	44	Sept. 15.	
							Oct. 13.	Aug. 20.
30·40+	S.W.	18	Aug.	12—	N.W.	46	Nov. 13.	Sept. 22.
29·64—	S.W.	23	,,	20+	E.	88		Oct. 21.
29·02—	S.E.	6	Sep.	1+	N.W.	76		
30·38+	N.E.	15	,,	22—	E.	32		Nov. 11.
								Dec. 11.
30·31+	S.W.	13	Oct.	6—	S.W.	28		
29·40—	S.W.	25	,,	21+	S.E.	71		
							Total	Total
28·80—	S.W.	13	Nov.	11+	S.W.	54	14	15
30·60+	N.E.	21	,,	25—	N.E.	20	Recurring	Recurring
							Periods	Periods
29·11—	S.W.	2	Dec.	11+	S.E.	55	of	of
30·70+	N.E.	27	,,	21—	N.W.	28	Barometer.	Thermom.

Digitized by Google

In the table on page 115 I have brought another great feature of the weather into consideration—viz., the wind. It may seem very strange and immethodical to vary the accounts of different years so much; it might appear better to have had an uniform character. But the facts were slowly developed, one by one: first, the barometer and its tidal waves; then the thermometer after a long interval, thinking heat obeyed no law, or was not amenable to order. With these I was content, and the subject appeared complete; but electricity and magnetism presented themselves casually, and it was not easy for me to believe that they agreed in the recurring periods. The dew point was so trivial, that I did not deign even to look at it; and, last of all, came the most variable, fickle, and inconstant element, "the wind." It appeared curious to see the winds turn about and act in accordance with the barometer and thermometer.

The questions then reverted to my mind as to what are the winds? what causes them? whence come they? and whither do they go? Or, do the winds rule and over-rule the barometer and thermometer? Are they primarily a cause or an effect? In the wonderful book of Job (xxviii. 25)—"God understandeth the way thereof, and he knoweth the place thereof. For he looketh to the ends of the earth, and seeth under the whole heaven; *to make the weight for the winds; and he weigheth the waters by measure.*"

Now this is precisely the definition of the barometer:

Digitized by Google

"It weighs the atmosphere by measure." And "to make the weight for the winds" is the solution of the whole problem; for it is the difference of the weight of the air between any two places which is the cause of the winds, and the strength is in proportion to the difference of the weight and the proximity of the places to each other. These are the main facts and the specific points.

It appears to me that these expressions are most remarkable, and certainly very significant and suggestive; for the translation was in 1611, when the air was not known or even deemed to have any weight, and the barometer was not discovered until thirty years afterwards, therefore the translators had no idea of this bearing or import of the sentences.

Madeira is a name ever dear, and of transcendant fame, and styled by some a gem of the ocean, being situated in earth's fairest parallel, and blessed with many great and natural endowments, such as may justly entitle it to our admiration and praise. It is in latitude 32° N., and 17° W. longitude; and 1,320 miles from Southampton, the port from which the steamers sail. The island is thirty-eight miles long, twelve broad, and ninety-six miles in circumference. It is a garden of nature, and a fruitful vineyard, detached from the world, where the sick may resort and find comfort and ease, with much to delight and to please, until they sink into rest, and take up their abode in mansions more blest, and where only saints immortal reign.

Madeira I design to regard as a meteorological

Digitized by Google

type of the ultra-tropical, or infra-zodiacal region, comprising that great and important belt which encircles the globe, from the verge of the tropics to the parallel of 33° or 34° of latitude in both hemispheres respectively. It extends, like the zodiac in the heavens, 10° beyond the ecliptic, or sun's path, which the tropics denote. It comprises the finest climates on the face of the globe, and has Buenos Ayres, or Good Air, and the Vale of Paradise, or Valaparaiso—suggestive names — within its borders; Jerusalem and the Holy Land — lands flowing with milk and honey; and Egypt, the first-born of science and the arts, and all that ancient history commemorates and hands down to us; and even Paradise itself, all are within this lovely zone, which encircles the earth with a wreath of beauty. It occupies about the middle region of the habitable globe, and holds an important influence over the climates of the earth, and has specific characters and actions. Moreover, it is one of our responding areas, and claims our peculiar favour as being at the source or origin of our soothing, soft, and balmy breezes from the S.W., the great and preponderating S.W. current.

The table is from Dr. Heineken, the best and most accurate observer, whose account was published in the "Philosophical Magazine." Other eminent observers have resided at Madeira, as Dr. Heberden, Dr. Gourlay, Mason, the inventor of the wet-bulb hygrometer, Dr. Andrew Combe, and other medical men of deserved reputation.

Digitized by Google

FUNCHAL, MADEIRA—LAT. 32° 37′ N., LONG. 16° 35′ W. DISTANT FROM LAND'S END, ENGLAND, 1330 MILES.—1826.
DAYS OF HIGHEST AND LOWEST BAROM. & THERMOM.

BAROM.	WIND.	DAY.	MONTH.	DAY.	WIND.	THER	ANALYSIS BAROMETER.	ANALYSIS THERMOM.
30·25	W.	1	Jan.	4	N.W.	50	Jan. 1.	Jan. 8+
29·63	N.W. rain	4	,,	8	N.	69	Feb. 1.	Feb. 9.
								March 8.
29·91	W.	1	Feb.	9	W.	51	April 20.	
30·59	E.	18	,,	28	S.E. sir.	68	May 18.	Feb. 28.
							June 19.	March 26.
30·34	E.	5	March	8	E.	69		
29·68	N.W. rain	24	,,	26	N.W.	51	May 6.	June 29.
							June 5—4	July 28.
30·30	N.E.	12	April	18	W.	72	July 2.	Aug. 28.
29·83	W.	20	,,	21	N.	55		Sept. 29.
							July 29.	
29·74	S. rain.	6	May	10	W.	69	Aug. 31.	Sept. 16.
30·24	N.E.	16-18	,,	12	N.E.	55		Oct. 17.
							Aug. 6.	
30·31	N.E.	4-5	June	1	N.	58	Sept. 6.	Nov. 2.
30·05	W.	19	,,	29	E.	73	Oct. 4.	Dec. 2.
30·24	E.	1-2	July	16	N.E.	63	Nov. 29.	
29·91	W. rain	29	,,	28	W.	76	Dec. 27.	
29·85	E. siroc.	6	Aug.	22	N.E. sir	82		
30·23	N.E.	31	,,	28	N.E.	65		
							Total	Total
30·25	N.E.	6	Sept.	16	N.W.	64		
29·95	W. rain	26	,,	29	E	85	15	13
30·24	N.E.	4	Oct.	1	E.	77	Recurring	Recurring
29·80	W. rain	18	,,	17	N.E.	58	Periods	Periods
29·39	W. rain	24	Nov.	1-2	S.E. rain	72	of	of
30·39	N.E.	29	,,	28	N.E.	52	Barometer.	Thermom.
30·37	N.E.	4	Dec.	2	N.E.	68		
29·74	S.E. rain	27	,,	20	E.	52		

18th February, Highest Bar.	30.59	Highest Ther.,	85°	Sept. 29th.
24th November, Lowest	29·39	Lowest	51°	Feb. 9th.
Extreme Range	1·20		34°	
Mean of the Year	30·13	Mean of the Year	66°	

Digitized by Google

MEAN BAROMETER AT LONDON AND MADEIRA, FOR THE YEAR 1826.

1826.	MEAN BAROMETER. MADEIRA.	MEAN BAROMETER. LONDON.	DIFFERENCE.
January	30·049	30·104+	·055+
February	30·378+	30·098	·280
March	30·083+	30·040	·043
April	30·140+	30·032	·108
May	30·083+	30·063	·020
June	30·166	30·283+	·117+
July	30·346+	30·010	·336
August	30·108+	30·027	·081
September	30·116+	29·947	·169
October	30·059+	29·964	·095
November	29·964+	29·858	·106
December	30·127+	29·956	·171
Mean	30·136	30·031	·105

We perceive that for ten months in the year the mean barometer was highest at Madeira, and only during two months the highest mean at London; that the mean barometer of the year was highest at Madeira by one-tenth of an inch, which is equivalent to a pressure of 7·2 lbs. upon the square foot.

It is from this general pressure being higher than that of either zone, north or south of it—that two opposite winds proceed. The mean barometer of London was above its usual standard, it being an extraordinary fine year, but it was the reverse at Madeira.

The mean barometer at Madeira being 30·136.
While the mean of the year at London is 29·826.
·310.

Which gives the large preponderance of weight or pressure to Madeira of 21 lbs. upon the square foot.

Digitized by Google

COMPARISON OF THE MEAN TEMPERATURES OF MADEIRA AND LONDON.

MADEIRA.			MADEIRA LONDON.		DIFFERENCE BETWEEN MADEIRA AND LONDON.	
MEAN. Maxmum of the day.	MEAN. Minimum of night.	MONTHS.	Mean Temp.	Mean Temp.		
65	55	January	60	35	25	January.
69	55	February	61	38	23	February
71	53	March	63	40	23	March
75	58	April	65	45	20	April
77	61	May	67	52	15	May
80	63	June	69	58	11	June
80	66	July	71	61	10	July
80	66	August	72	60	12	August
79	66	September	72	56	16	September
77	62	October	69	49	20	October
73	57	November	65	42	23	November
72	55	December	64	38	26	December

To enter into a detail of all the comparisons which the tables would admit of, would exceed the reasonable bounds of the present work. But the tables of London and Madeira, when analyzed and contrasted, furnish a very considerable amount of information, and, indeed, may be regarded as presenting all the essential points of the climate of Madeira. We readily perceive that the maximum heat of some of our days in summer exceed those of Madeira—but the very next discloses the important fact that the night temperature of our summer nights is below that of the winter nights at Madeira. The mean temperature of the two places differ very considerably indeed—and which is one of the most important points.

Digitized by Google

I have been purposely diffuse upon subjects which appear irrelevant, but are strictly connected with, and immediately dependant upon, the climate, although they are discarded from meteorology. But what better exponents have we than the vegetable kingdom in its fruits and flowers? They speak an intelligible language, and are unerring tests. The orange and the camellia thrive at Madeira, and what more lovely companions or graceful adornments of the winter season can be imagined? Both are universal favourites; and wherever they *thrive* under nature's maternal care, without any foster aid, there the winter is mild and genial, and the thermometer scarcely sinks below 50°. They are nature's types of a fine winter climate, because the orange perfects its fruit, and the camellia spreads its lovely flowers in the depth of winter. They are in this sense winter plants, at any rate they are the correct and sure indications of a mild winter climate, suitable for the most delicate invalid. The orange is a winter fruit, and the camellia is the belle of the season. The orange is a medicinal fruit of the highest virtues, and its flowers form a portion of the maiden's marriage wreath, and the camellia is everywhere a justly admired ornament, and which has the merit of enduring longer than most of the floral beauties. But in the winter it is without a compeer and without a rival, and it is so beautifully set in ornamental leaves, as to find favour and admission everywhere.

The coldest winter month at Madeira has, it will be observed, the same mean temperature as our warmest

Digitized by Google

summer month, and an inspection of the tables will convey all the required information respecting this delightful climate.

When considering the state of the polar atmosphere, in reference to its density and weight, when compared with the levity and warmth of the air of the tropics, there appeared to be a barrier of high pressure on the zodiacal regions, or in that region beneath the zodiac. And the extent was somewhat parallel to the zodiac, and extended about 10° on either side of the tropics. On referring to the tables from the Observatory, Port Louis, from which alone we could compare and estimate the polar atmosphere, it will be seen that the mean barometer of the year at Port Louis was 30·11. Madeira presents us with the same fact in the northern hemisphere — a ridge, zone, or belt of high pressure intervening from the verge of the tropics to the parallel of 32·33 on both sides of the equator.

The mean barometer of the year at Madeira is 30·11. From the southern margin of this zone, the gentle and continual trade winds descend or flow into the tropics with grateful and refreshing coolness. The high pressure of this zodiacal zone gives the northern character, while the sun leads this wind in its train, and gives its easterly direction. Hence the N.E. trade, and the S.E. on the other side, form the trade winds.

But this is not its only office, its benefits and blessings are many and great. From the northern margin of the zone of high pressure proceed those soft and balmy breezes from the south, and our S.W. favourite gales.

Digitized by Google

They come with a rich freight of vapour, and clouds laden with a treasure more precious than gold.

It is this zone of pressure which sends them on their course, and they constitute one of the chief and most important features of our climate. Though frequent, they are not continual, like the trade wind; and why not, if the same cause gives rise to both? The trade wind meets with no opposing force, but every facility, for the equatorial barometer does not rise above 30°, therefore a weaker or lower pressure exists for the stronger one to blow into. But the S.W. breeze cannot always blow, because the northern barometer rises above that of the zodiacal region.

Thus for example, December 26th and 27th, 1826, the barometer was 30·70 at London, but at Madeira on the same day it was 29·70; therefore the greater pressure by one inch, or a difference between the two places of 36 lbs. upon the square foot of air. Hence the S.W. wind could not blow, but a reverse action, fine and tranquil in England, but at Madeira N.E. wind, with thunder and lightning and very heavy rains. Nor can we fail to admire the fluctuations of the barometer in the tropics, the zodiacal region, and the temperate latitudes. In the summer the tropical barometer is below the mean, but above the mean in the zodiacal regions. Hence the trade wind in summer has a higher latitude, but as the autumn approaches and winter comes on, the tropic barometer rises above its mean, and the zodiacal one sinks. Hence the trade wind decreases in latitude, and falls back towards the

Digitized by Google

equator, and a tropic wind blows into the zodiacal region, and brings on its rainy season in the winter, when the rains are over in the adjoining tropic. What a wonderful adjustment amid all the varying departments of nature, in order, time, and place.

There is another point worthy of notice in the difference of the mean temperature of the months between England and Madeira. June, July, and August differ only by 10° or 11°, but the autumnal and winter months, as November, December, and January, differ by 26°. Hence we perceive why the S.W. winds direct from these realms are so warm, moist, and relaxing, in these latter months of our autumn and the winter. No wonder that we have mild winters where these delightful winds blow from hence, where there is a mean temperature of 65°, and tepid waters of the ocean.

Reverse the wind to the N.E., direct from the cold and chilly realms of Russia and Siberia, where the mean temperature of January is 10° *below* the freezing point, and then how harsh and comfortless. But mark the difference of the mean summer temperature at St. Petersburg, which in June, July, and August is from one to two degrees *above* the mean temperature of London. Hence, with the clear unclouded sky and brilliant sun, with a N.E. air, it may be hotter and finer with us than with the S.W., which screens the sun with clouds and vapour, and is often cool.

I have just adduced the 27th December as an example of the difference of the barometer between

Digitized by Google

illustration from Mr. Howard's Notes, in December, 1826.

"St. Petersburg, December 27th. Winter did not set in here till yesterday. The freezing of the Neva has interrupted the communication with Vassili Ostrow. We do not remember the navigation of the Neva to have ever been open so late as this year. Since the year 1718, when the observations on the freezing of the Neva were first registered, the year 1772 was that in which the Neva continued open the longest, viz., to the 24th December."

The winter set in at St. Petersburg on the 26th December, and on that day the wind changed to N.E. in England, with high barometer, and fine weather; but at Madeira, on the 26th December, the lowest barometer, with N.E. wind, rain, thunder, and lightning.

Here was a direct line of atmospheric action, simultaneous, from St. Petersburg, England, and Madeira, a distance of about 3,000 miles. How beautiful, and how exquisitely delicate were the simultaneous movements of the mercurial columns of the barometer at London and Madeira, as quick and sensitive as the electric telegraph; the one gently falling, and the other rising, like the ends of the most accurate balance, turning even to the hundredth of a grain. Such is the demonstrated fact. Scarce a zephyr ruffles the air, but is responded to at some distant point. And can this mighty aërial ocean be subjected to such minute, yet extensive actions?

The year 1826 ended with warmth and genial

Digitized by Google

temperature. A letter from Sympheropol, in the Crimea, dated Christmas Day, says, "At that time there was no appearance of winter in the Peninsula. The rose trees in the garden were still green, the stocks in full blossom; and in the beginning of December there were strawberries nearly ripe in many places."

London and Madeira are mutually influenced in respect to the movements of the barometer, and they oscillate and respond oftentimes to each other. The year 1826 was very warm and dry, and the barometer was above the mean at London.

At whichever of the two places the barometer was the highest, from that place the wind blew, and its strength being in proportion to the difference of the pressure. The year in England was deficient of the usual quantity of S.W. winds. Whenever the barometer at Madeira attained a much greater elevation than at London, then a S.W. gale blew; and the reverse was when the London overtopped considerably the Madeira one, then a N.E. gale or breeze; the wind or current of air being the result of the greater pressure flowing in an area of low pressure.

And in this action Madeira and London often reciprocate. The mean barometer at Madeira exceeds that of London—hence the beneficent gift of our soft and balmy S.W. winds—the warmer air coming to us, fraught with the clouds and vapour of the ocean, impelled by the barometric pressure of the Madeira area. This makes our winters so mild; and much are we blessed by this ordination.

Digitized by Google

FORT FRANKLIN, LATITUDE 65° NORTH AND 123° WEST LONGITUDE. SECOND EXPEDITION BY JOHN FRANKLIN, CAPT. R.N. AND F.R.S.

DAY.	MONTH.	THERMOMETER.	ANALYSIS.
1825			
20	September	60	September 4 —
4	,,	30	October 6 +
6	October	40	November 1 +
28	,,	—22 below zero.	December 1 +
1	November	32 freezing pnt.	January 1 —
14	,,	—22 below.	
1	December	+27 above.	December 25 —
25	,,	—47 below.	January 24 +
1826			
24	January	+11	February 5 —
1	,,	—49	March 7 +
15	February	+27	April 7 —
5	,,	—39	
7	March	+31	February 15 +
13	,,	—43	March 13 —
18	April	+41	July 10 —
7	,,	—23	August 10 +
31	May	61	September 7 +
4	,,	1	October 5 +
	June	Thermom. stolen.	November 5 —
	,,		
12	July	80	October 30 —
10	,,	30	November 29 +
10	August	74	
3	,,	33	
7	September	66	
19	,,	5	Total 19
5	October	47	
30	,,	— 6 below zero.	Recurring Periods
29	November	+20	
5	,,	—30	in 30 dates.
9	December	+22	
23	,,	46	

Digitized by Google

Amid frequent vicissitudes, and with a range of 70° in a month, as in January and March, where all would appear irregular, inconstant, and capricious, how wonderful and surprising that such an obedience to order and recurring periods should appear. The facts declare it and speak for themselves. Put what construction you please upon it, there is no avoiding the conclusion.

We cannot discern the cause of the alternating or reverse series, and say why the 15th of February should be the warmest day of the month, while the 13th of March, which is its recurring period, should be the coldest day of the month, and even be as much as 70° colder than the 15th February. We should have expected the 13th of March to have been as warm as that of February, considering the progression of the season. Look at another instance in the height of summer—10th July and 10th August. And yet in these strange reverses, the law of recurring periods holds its sway, and is the rule.

The register at Fort Franklin is associated with many reflections: the amiable and excellent character of Franklin himself—the enduring enterprise—the pathetic incidents of the first undertaking—and the unknown fate of the last expedition, constitute a thrilling narrative. He that loves energy will find it displayed therein; he that admires human nature will see examples to excite it; and whosoever loves knowledge may observe it in Franklin and his companions.

Digitized by Google

THE YEAR 1834, FROM "THE CLIMATE OF ENGLAND," BY MR. ORLANDO WHISTLECRAFT.

BAROM-ETER.	WIND.	DAY.	MONTH.	DAY.	WIND.	THER	ANALYSIS. BAROMETER.	ANALYSIS. THERMOM.
30·44+	N.W.	2	Jan.	23+	S.W.	58	Jan. 10.	Feb. 10.
29·21—	S.E.	10	,,	30—	NW.SW.	29	Feb. 12.	March 9.
29·73—	S.	12	Feb.	10—	S.E.	27		
30·61+	N.E.	28	,,	27+	S.W.	58		
30·68+	E.N.E.	19	March	9+	W.	61	Feb. 28.	April 29.
29·53—	S.W.	28	,,	19—	E.	29	March 28.	May 31.
30·54+	SW.N.W.	3	April	15—	S.E.	29	April 28.	
29·43—	S.W	28	,,	29+	S.W.	67		May 8.
29·50—	S.W.	17	May	8+	S.W.	78	May 17.	June 8.
30·62+	N.E.	21	,,	31—	N.W.	35	June 16.	
29·70—	W.S.W.	16	June	1-8—	E.S.E.	42		June 1.
30·53+	N.E.	30	,,	21+	S.S.E.	88		July 1.
30·27+	N.E.	1	July	1—	N.E.	44	Aug. 16.	
29 58—	S.W.	19	,,	17+	E.	87	Sept. 14.	
30·32+	N. E	16	Aug.	13+	S.	85	Oct. 17.	Aug. 13.
29·72—	var S.W.	24	,,	24—	var.	47	Nov. 14.	Sept. 15.
29·57—	W.	9	Sep.	15—	E.	41		Oct. 6.
30·60+	var. E.	14	,,	19+	S.S.W.	80	Oct. 29.	Nov. 7.
29·25—	N.W.	17	Oct.	6+	S.	77	Nov. 29.	Dec. 7.
30·72+	var. N.	29	,,	24—	N.W.	32		
30·50+	N.E.	14	Nov.	5-7+	S.W.	62		Oct. 24.
29·30—	W.	29	,,	26—	N.W.	30		Nov. 26.
29·31—	S.W.	1	Dec.	7-31+	S.W.	54		Dec. 24.
30·70+	N.E.	11	,,	24—	N.W.	24		

13 Recurring Periods of the Barometer.

16 Recurring Periods of the Thermometer.

Digitized by Google

ST. JOHN'S, NEWFOUNDLAND, LATITUDE 47° NORTH; LONGITUDE 52° WEST.—MR. JOSEPH TEMPLEMAN, OF THE COLONIAL OFFICE. TRANSACTIONS OF THE METEOROLOGICAL SOCIETY OF LONDON.

DAY.	BAROMETER.	MONTH.	THERMOM.	DAY.	ANALYSIS OF THE BAROMETER.
30	30·30	January	36+	18	February 27.
22	28·60	,,	— 7—	31	March 28.
					April 29.
10—18	30·35	February	40+	16	
27	28·50—	,,	14—	6	February 10.
					March 8.
8—28	30·30	March	46+	22	
14	28·80	,,	6—	3	May 16.
					June 15.
5	30·42	April	46	25	
29	28·80	,,	13	17	August 14.
					September 14.
16	30·40	May	57	10	
1	29·35	,,	24	30	August 8.
					September 7.
6	30·27	June	76	8	
15	29·35	,,	30	18	September 10.
					October 10.
20	29·28	July	86	15	
1	29·48	,,	37	1	October 19.
					November 17.
31	30·25	August	78	25	December 19.
8—14	29·40	,,	36	10	
					November 8.
14	30·32	September	74	3	December 7.
7—10	29·51	,,	36	16	
12—19	30·30	October	70	10	
10	29·40	,,	28	26	
					Total
17	30·13	November	52	15	18 Recurring
8	29·11	,,	15	29	Periods.
19	30·67+	December	45	15	
7	29·98	,,	4	29	

Digitized by Google

I have introduced the table on the preceding page with a threefold view. First, As giving an epitome of the climate of Newfoundland; Secondly, As an example of recurring periods; and Thirdly, For comparison with our own climate.

"It is stated that in the peculiar climate of this island the mean temperature of September is very little below that of July, whilst that of October is nearly equal to June. The first portion of February is usually the severest part of the winter, the thermometer sometimes sinking from 10 to 20 degrees below zero of Fahrenheit.

"The barometer is rarely ever steady for six hours together. In winter its oscillations are very great and sudden, sometimes as much as from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in the course of thirty-six hours. These take place in the winter months, during which is experienced, in the course of every four days, almost every variety of weather. The barometer attains, during that interval, to the height of from 30·20 to 30·40, the weather calm and serene, and the cold severe; the barometer soon indicates a change; a breeze springs up from S.E. and increases to a gale, with snow and drift. This is sometimes succeeded by a heavy rain from S.W.; the temperature which in the morning was near zero rises to above 40°, and in a few hours the wind suddenly veers to the N.W. During the S.W. gale the barometer rapidly sinks, often to 28·5, and on the accession of the N.W. breeze as rapidly rises again. This routine of weather is repeated throughout the winter."

Digitized by Google

Such is the account of this most changeable climate, and yet, amid all these perturbations, how surprising it is that such a large number as 18 out of 24 dates should be recurring periods. It is a remarkable exemplification of the principle, or law, where we should almost expect it to be set aside.

A comparison of the unenviable climate of Newfoundland with that of England, may not be without some little influence in divesting the minds of some of an undue prejudice. It is too often urged that the climate of England is so much more changeable than almost any other. I have endeavoured to dispel such an idea, and likewise stated that we had the mildest winter climate, for our parallel of latitude, of any on the globe. Newfoundland is four degrees to the south of London, and yet how severe and cold its rigorous winter—harbours frozen, and snow-clad soil—the mean temperature of the year being only 39°, while that of London is 49°. Newfoundland is an example, when compared with England, which exalts us considerably, and should not only satisfy us, but render us grateful for the beneficial climate we possess.

But if we compare Newfoundland in latitude 47°, with the Orkney Isles in latitude 60°, what an amazing difference do we find between them. Thus, the Orkney Islands in January have a mean temperature of 39°, and scarcely ever any frost, while the island of Newfoundland, although so very much further to the southward, has only in January a mean temperature of 24 degrees, and frequently below zero. Surely the mere local tem-

Digitized by Google

perature is not the absolute temperature of the vertical column, for we cannot suppose that such irregularities exist in the height of the atmosphere, which must be the case if the local temperature is the index. Nor can we suppose the wave, or tidal movement of the column follows these local and capricious variations of the barometer. These perturbations are confined to a moderate space, and do not reach to any considerable height.

A submarine or oceanic electric telegraph is about to be laid between Ireland and Newfoundland, and thus establish a communication between Europe and America. Gigantic as such a work undoubtedly is, and wonderful even that it should be contemplated, much less even attempted. That an iron cable reposing on the ocean's bed should be the means of our holding converse with places 1,690 miles apart, is a presumptive evidence in favour of an atmospheric action. For light, heat, and electricity, are the spirits of the air—it is their abiding place. Free and unimpeded they speed their flight along the blue ethereal firmament, or upon the canopy of clouds, and thus distant places hold communion with each other, obey the general impulse, act and re-act upon each other, and sustain a constant intercourse. No change in one but what is connected with some other, for there is no isolation, no solitary effect, but a social intercourse. "Day unto day uttereth speech, and night unto night showeth knowledge. *There* is no speech nor language *where* their voice is not heard. Their line is gone out through all the earth, and

Digitized by Google

their words to the end of the world." "Keep back thy servant from presumptuous *sins:* let them not have dominion over me." (Psa. xix.)

And as Newfoundland, America, and Ireland, are to be connected by the submarine telegraph—so they really are connected by nature's electric telegraph—which is always at work; they communicate almost instantaneously with each other. And how can we detect such? By the atmospheric instruments—the barometer and the thermometer; and their evidence is quite as decisive as any message by the telegraph itself. The epitome of the year 1834, at Newfoundland and England, will show the fact as recorded for our conviction.

It appears by a comparison of the tables of England and Newfoundland, that they are repeating atmospheric stations—that a simultaneous action takes place, sometimes being a correspondent action or a similar state at both places, at other times a reverse action. In the year 1834, I find from the tables that the barometer had twelve critical days—simultaneous at both places—six of which were similar and six were reverse states. That the critical days of the thermometer were fourteen, simultaneous or synchronous, eight of which were similar, and six reverse states. Newfoundland and England are corresponding stations in respect to the atmospheric states, and there is some mutual influence, some bond of union, and some accordance of action between them, some reciprocating condition.

Digitized by Google

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

ROYAL OBSERVATORY, GREENWICH,

IN THE YEAR 1845:

UNDER THE DIRECTION OF

GEORGE BIDDELL AIRY, ESQ., M.A.,

Astronomer Royal.

PUBLISHED BY ORDER OF THE BOARD OF ADMIRALTY IN OBEDIENCE WITH HER MAJESTY'S COMMAND.

It is almost as unnecessary as it would be unbecoming in me to attempt any praise of a work which proceeds from the most eminent authorities. The Queen, the Lords of the Admiralty, and the Astronomer Royal, are the highest honours of the land. Nor is this honour a fading name. Whatever emanates from the Royal Observatory, Greenwich, is of the highest order. And it is delightful to have meteorology sheltered under the patronage of the noblest, the most perfect, and the most exalted of all sciences, viz., Astronomy. For when we consider the order, the minuteness, and the exactness of astronomical observation, we consequently obtain the services of persons most accustomed to delicate research. The meteorological observations from Greenwich, from which I propose to make large abstracts, may be regarded as

Digitized by Google

the standards of excellence. They contain every minute circumstance of *time*, and with the state and condition of the atmosphere and the instruments. They may be justly considered as perfect, and combining all the points necessary for inquiry and research.

From them there is no appeal; by their testimony I must abide. I have selected only one year—that of 1845—but that one alone is decisive and clear, and establishes the points I have in view, without reference to any other authority whatever.

The history of the year 1845 would form an important work, for its events, natural, moral, and political, are of such peculiarity and magnitude, as to constitute an epoch of *enduring* interest, and is capable of supplying abundant materials for deep reflection. It is still with us. The atmospheric actions are the ministering agents of the Deity—messengers from heaven and monitors to mankind. Through the instrumentality of the atmosphere we more directly perceive the superintendence and direction of God than in most other operations of nature. For climate, seasons, and weather over-rule all things with individuals, nations, and empires alike. Health, life, and death, are much dependant upon atmospheric influences, and they are often the arbiter of our happiness and enjoyments. A fine day is very delightful, but a fine year is an inestimable blessing. The fruits of the earth are very precious, and a bountiful harvest rejoiceth the hearts of the people.

Digitized by Google

ABSTRACT FROM THE METEOROLOGICAL OBSERVATIONS MADE AT THE ROYAL OBSERVATORY, GREENWICH.

BAROM.	WIND.	DAY.	MONTH.	DAY.	WIND.	THER.	ANALYSIS BAROMETER.	ANALYSIS THERMOM.
28·708—	W.S.W.	19	Jan.	6	S·W·	51	Jan. 21.	Feb. 26.
30·163+	E.N.E.	21	,,	31	N.	24	Feb. 22.	March 27.
							March 21.	April 24.
30·352	E.	12	Feb.	11	E.N.E.	7		
29·328	S.S.E.	22	,,	26	W.S.W.	48	March 3.	May 27.
							April 1.	June 28.
29·440	S.W.	3	March	13	N.E.	13		July 29.
30·376	W.S.W.	21	,	27	S.W.	59	April 9.	Aug. 31.
							May 8.	
30·185	E.	1	April	6	N.E.	29	June 9.	Feb. 11.
28·834	N.E.	9	,,	24	S.W.	70		March 13.
							June 27.	
29·281	S.W.	8	May	10	N.	34	July 28.	Sept. 23.
30·187	N.E.	14	,,	27	S. W	68	Aug. 30.	Oct. 25.
								Nov. 22.
30·267	W.	9	June	13	S.E.	86	Aug. 19.	
29·124	S.W.	27	,,	28	N.W.	43	Sept. 18.	
30 108	S.W.	4	July	7	S.W.	83	Nov. 19.	
29·423	S.W.	28	,,	29	N.W.	44	Dec. 19.	
28·988	S.W.	19	Aug.	1	S.W.	43		
30·208	N.E.	30	,,	31	N.	77		
30·176	N.E.	1	Sept.	9	S.W.	73	Total	Total
29·160	S.W.	18	,,	23	N.	33	15	12
29·092	S.	8	Oct.	3	S.W.	67		
30·445	N.W.	22	,,	25	N.	31	Recurring	Recurring
30·246	N.E.	3	Nov.	6	S.	59	Periods	Periods
28·965	S.W.	19	,,	22	N.W.	29	of	of
30·358	N.	12	Dec.	12	N.	28		
28·659	S.W	19	,,	30	S.W.	55	Barometer.	Thermom.

Highest Bar. 22nd October	30·445	Highest Ther., June 13th.	86°
Lowest 19th December	28·659	Lowest	7°
Extreme Range	1·786	Extreme Range	79°

Digitized by Google

THE MAXIMA AND MINIMA VALUES OF THE MEAN DAILY HEIGHTS OF THE BAROMETER FOR THE YEAR 1845, FROM GREENWICH OBSERVATIONS, (*page* 25).

BAROMETER MEAN.	DAY.	MONTH.	ANALYSIS. BAROMETER.
30·125	7	January	Feb. 12.
28·886	28	,,	March 14.
30·303	12	February	Feb. 22.
29·367	22	,,	March 22.
29·550	14	March	April 10.
30·270	22	,,	May 8.
			June 9.
30·136	1	April	June 28.
28·928	10	,,	July 31.
29·329	8	May	August 30.
30·151	15	,,	August 19.
30·226	9	June	Sep. 18.
29·288	28	,,	Nov. 19.
			Dec. 20.
30·064	5	July	
29·459	31	,,	
29·182	19	August	
30·177	30	,,	Total
30·130	1	September	
29 255	18	,,	14
29 207	9	October	Recurring
30·406	23	,,	Periods
30·201	3	November	
29 051	19	,,	of Mean
30·319	13	December	Barometer.
29·755	20	,,	

Digitized by Google

ABSTRACT OF THE RESULTS OF THE OBSERVATIONS OF THE THERMOMETER AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1845—

Containing the Mean Daily Temperature, as deduced from the Mean of the 12 Observations taken on every day of the year, at the even hours of Gottingen Mean Time, (page 35).

MEAN TEMPERATURE.

DAY.	MONTH.	Highest and Lowest	WIND.
11	January	46	S.W.
30	,,	30	N.W.
11	February	24	N.E.
26	,,	43	N.W.
13	March	22	N.E.
27	,,	51	S.W.
1	April	38	N.E.
25	,,	55	S.W.
1	May	56	S.W.
7	,,	42	N.W.
4	June	52	S.W.
14	,,	69	S.E.
7	July	71	S.W.
15	,,	55	N.W.
5	August	61	S.W.
16	,,	52	N.W.
17	September	61	S.W.
24	,,	44	N.E.
3	October	61	S.W.
24	,,	42	S. calm
6	November	53	S.W.
24	,,	35	N.W.
13	December	31	N.W.
30	,,	49	S.W.

ANALYSIS.

MONTH.	DAY.	WIND.
January	11+	S.W.
February	11—	N.E.
March	13—	N.E.
February	26+	N.W.
March	27+	S.W.
April	25+	S.W.
April	1—	N.E.
May	1+	S.W.
June	14+	S.E.
July	15—	N.W.
August	16—	N.W.
September	17+	S.W.
July	7+	S.W.
August	5+	S.W.
September	24—	N.E.
October	24—	S. calm
November	24—	N.W.

The number of Recurring Periods of the Days of Highest and Lowest Mean Temperature is 17 out of the 24 dates.

The direction of the winds is an important addition, showing their connection with the temperature, and likewise their tendency to recurring periods.

Digitized by Google

The following observations by Mr. Glaisher evidently exhibit the recurring periods of the 27th, and their being critical days in the strictest and fairest sense of the word.

EXTRAORDINARY METEOROLOGICAL OBSERVATIONS AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1845.

Remarks on unusual Phenomena in the Winter, common to the Years 1844 *and* 1845, *particularly relating to the Temperature of the Air, and that of Vegetation.*

1844.

Nov. 20, 21—Was the beginning of a remarkable period of cold.

Nov. 27—Was the lowest temperature of the month, 23°, and the temperature continued below the average until

Dec. 27—When a warm period set in, and continued until

1845.

Jan. 27—When the cold set in again with increased severity, and continued below the average every day until

Feb. 26—Which was the only solitary exception of a warm day, until on March 20 and 21 the cold diminished, and on

March 27—The temperature attained its maximum of 59°.

Readings of the Thermometer in different positions, on 12 *February, in consequence of the temperature of the air being at Zero, at* 7*h.* 25*m. a. m. by the Minimum Self-Registering* 1·5 *below.*

At the Royal Observatory Greenwich		7·5°
On board of the Dreadnought, moored off Greenwich		10°
At Mr. Glaisher's residence, Lewisham, about a mile from the Observatory	below zero	—1·5°
Three other Thermometers stood at zero.		
On the snow exposed to the sky	below zero	—12·6°
In the snow		+18°

Digitized by Google

Under long grass, covered by snow, 3 inches	28°
But on long grass, cleared of snow	below zero —6°
On flax laid on the snow, probably a point lower than observed before in this climate	—12·5°
In the air at the height of 12 feet	+11·9°

There was considerable difference in the temperature as recorded at other places.

At Cambridge University	14°
At the Botanical Gardens, Regent's Park, Mr. Bishop	4°
At the Horticultural Gardens, Cheswick, during the night	below zero 3°
,, ,, ,,	and at 8 in the morning only 4°

1845.

March 14th, at 5h.—6h. A. M.

Dry bulb Thermometer in the air	13°
On long grass	0°
On short grass	8°
On white raw wool	below zero —4°
In focus of parabolic reflector	7°
On the surface of the ground under short grass	20°
,, ,, long grass	26°
On white wadding on grass	6°
On black ,,	5°
On lamp black	2°
On charcoal	3°
On whiting	5°
One inch below the surface of the ground, covered by the snow	32°
At twelve feet in height in the air	15°

These observations the observer (Mr. Glaisher) believes are without a parallel on record, at a time so near the vernal equinox, for at noon the thermometer was only 23°.

Digitized by Google

ABSTRACTS OF THE RESULTS OF THE METEOROLOGICAL OBSERVATIONS AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1845.

MEAN HEIGHT OF THE BAROMETER.	MONTHS.	MEAN TEMPERATURE DEDUCED FROM SELF-REGISTERING THERMOMETER.
INCHES.	1845.	DEG.
29·704	January	38
·840	February	—33
·795	March	36
·696	April	48
·712	May	51
·775	June	+62
·769	July	61
·729	August	59
·801	September	55
·847+	October	51
·575—	November	46
·658	December	41
Mean 29·742.		48° Mean

The daily motion of the mercurial column of the barometer exhibits a double maximum, and a double minimum; the former occurring at 10 A. M. and at midnight, the first minimum occurring at 4 P. M. and the second at 4 A. M.

The maximum at about . .	10 A. M.
The minimum „ . .	4 P. M.
A second or approximate maximum	midnight
A second or approximate minimum	4 A. M.

The daily motion of the mercurial column of the barometer has been very different throughout the whole of this year 1845, especially during the winter, when a little after midnight there occurred a rise, whereas in every previous year there was a large fall. The variations of the pressure of the atmosphere have been greater in amount than those of previous years.

Digitized by Google

ABSTRACTS OF THE RESULTS OF THE TEMPERATURE OF THE DEW POINT, AT THE ROYAL OBSERVATORY GREENWICH, IN THE YEAR 1845.—THE DAYS OF HIGHEST AND LOWEST DEW POINT; AND THE DAYS OF GREATEST AND LEAST WEIGHT OF VAPOUR IN A CUBIC FOOT OF AIR.

HIGHEST AND LOWEST DEW POINT.		CUBIC FOOT OF AIR CONTAINING WEIGHT OF VAPOR IN GRAINS.		ANALYSIS.	
DAY.	MONTH.	DAY.	GRS.	HIGHEST & LOWEST DEW POINT.	CUBIC FOOT VAPOUR.
+11	January	11	3·63	Feb. 26.	Jan. 11.
—30	,,	30	2·09	March 27.	Feb. 12.
					March 14.
—20	February	12	1·34	April 30.	
+26	,,	26	2·76	May 28.	Feb. 26.
					March 27.
—13	March	14	1·20	April 7.	
+27	,,	27	3.64	May 6.	April 7.
				June 4.	May 6.
— 7	April	7	2·28		June 4.
+30	,,	30	4·40	June 13.	
				July 12.	July 7.
— 6	May	6	2·90		August 5.
+28	,,	28	4·71	July 7.	
				August 5.	April 30.
— 4	June	4	4·09		May 28.
+13	,,	13	6·52	Aug. 16.	
				Sept. 17.	June 13.
+ 7	July	7	6·26		July 12.
—12	,,	12	3·78	Sept. 24.	
				Oct. 24.	Aug. 21.
+ 5	August	5	5·50	Nov. 24.	Sept. 24.
—16	,,	21	4·02		Oct. 21.
					Nov. 24.
+17	September	17	5·76		
—24	,,	24	2·91	Total 16	
+ 3	October	3	5·77	Recurring	Total
—24	,,	21	2·96	Periods	18
+ 8	November	8	4·14	of the	Recurring
—24	,,	24	2·29	Dew Pnt.	Periods.
—13	December	13	2·30		
+18	,,	30	3·05		

It is unnecessary to give the days of the greatest and least elastic force of vapour, as they so very nearly accord with the Dew Point, but they afford 19 Recurring Periods out of the 24 dates.

Digitized by Google

When I came to the Dew Point, I thought it a subject too trivial to look at, and never for a moment had an idea that it obeyed any law or period; in fact, that it was a casual occurrence.

Such was the first impression of the Dew Point; but when I compared it with the temperature, and perceived the connection with that important agent, it exalted my idea of the incomprehensible wisdom of the Almighty, who numbers the dew drops, and assigns to them weight and magnitude.

How beautiful it now appeared! And that the great law of order should pertain even to those little precious dew drops that spangle the bushes, and are so charming and graceful. They heretofore seemed too insignificant to attempt to regulate, and so fitful and evanescent as to be less than a moment's duration.

Although I knew that the dew was dependant upon the temperature, yet it could not reconcile my mind to give it any place in the great system of recurring periods. How much more insignificant were my thoughts than the little dew drops! They are not neglected nor overlooked, but form an essential, and even a great part of the arrangements of the atmosphere. The dew is but a portion of the vapour, and what is the vapour of the atmosphere but almost its soul and life? The dew of heaven and the gracious rain are the essential elements of plants and animals, and without which the earth is but a sterile desert.

Digitized by Google

ABSTRACTS OF THE RESULTS OF THE MAGNETICAL OBSERVATIONS AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1845.

DAYS OF THE GREATEST AND LEAST MEAN WEST DECLINATION.		THE VERTICAL FORCE (OR DIP) MAGNET. GREATEST AND LEAST READINGS.	ANALYSIS.	
DAY.	MONTH.	DAY.	DECLINATION.	DIP.
+ 3	January	24—	January 3+	February 27
—10	,,	30+	February 5+	March 25
+ 5	February	10+	February 24—	March 17
—24	,,	27—	March 24+	April 16
+24	March	17+	April 24+	April 30
—27	,,	25—	May 23+	May 29
			March 27—	June 27
+24	April	16+	April 28	May 1
—28	,,	30—	May 30	June 2
+23	May	1+	August 14	July 3
—30	,,	29—	September 12	August 1
— 2	June	2+	November 5	August 14
+11	,,	27—	December 5	September 15
+ 7	July	3	November 29	October 3
—26	,,	23	December 29	November 5
—14	August	1		October 21
+22	,,	14		November 22
+12	September	12		
—29	,,	15		
— 9	October	3	Total	Total
+17	,,	21	15 Recurring	17
+ 5	November	5	Periods of the	of the Vertical
—29	,,	22	Declination.	Force Magnet.
+ 5	December	1—		
29	,,	30+		

The mean westerly declination for the year 1845 was 22 deg., 56 min.,. 43 sec.

Digitized by Google

The extreme range of the magnet was, in—

	MIN.	SEC.
January	31	28
February	30	49
March	30	18
April	26	46
May	33	18
June	17	45
July	25	49
August	39	8
September	33	18
October	38	48
November	24	21
December	57	57

The daily variation or diurnal period (recurring):

The maximum at	2 P. M.+
A subordinate minimum	2 A. M.
A subordinate maximum	4 A. M.
The minimum	8 A. M.—

—having a double maximum and minimum. Canton, in 1759, carefully observed the diurnal variation of the magnet, and found the maximum westerly variation at 2 P. M., and at 9 A. M. its maximum easterly variation, which is in strict accordance with the Greenwich Observations.

The electricity of the air exhibits a flux and reflux twice in every 24 hours, about 2 P. M. the minimum and about 9 A. M. the maximum force. The periodical electricity of the atmosphere is manifestly influenced by temperature. The aqueous vapours in the atmosphere are constantly electrified, and they are the principal seat or nidus of the electric fluid, and there is an electrical atmosphere within the aërial.

Digitized by Google

The manner in which the diurnal variation may be produced or affected by the action of the sun on our atmosphere—as the earth revolves in its beams—is considered by Professor Faraday to be chiefly owing to the highly magnetic constitution of the oxygen of the air.

"The magnetic constitution of oxygen seems to me wonderful," says Faraday; "it is in the air what iron is in the earth. In nature it stands in this respect, as in all its chemical actions, alone. In fact, there is nothing among the gases that compares with oxygen. Bulk for bulk, it is equal to three times its weight of iron. There is much to do with oxygen relative to atmospheric magnetism. The relation of the motion of the needle to that of the sun has long been known; it is as if the pole of a magnet came on with the sun, of like nature with the upper end of the needle, and drives it before it."

"The varying pressure of the atmosphere ought to cause a variation in the magnetic condition, for the action of oxygen is in proportion to its quantity, whether by volume or by weight; the magnetic force being made more intense by increased barometric pressure, at any spot which is towards the confines of the area of increasing or diminishing pressure, and more especially marked at such places as happen to be between the areas of high and low barometer, in one of which the air is accumulating, and from the other it is retreating."
—FARADAY.

Digitized by Google

CHAPTER VI.

Indications of a Daily Lunar Tide.—Its trivial amount.—Supposed effect of the Changes of the Moon on the Weather.—First impression of the Recurring Monthly Periods in favour of the Moon.—Mr. Howard's Investigation of the Lunar Influence, and his convictions in favour thereof.—Difference of result between Howard and the Greenwich Observations.—Mr. Howard's opinion respecting the Radiation of Heat from the Full Moon, and radiation from the Earth at New Moon.—Howard's Cycle of Eighteen Years in the Seasons of Britain.—The Recurring Periods are not coincident with the Lunar Phases.—Recurring Monthly Periods of the Thermometer not consonant with the Lunar Phases.—The Metonic Cycle, or Lunar Period of Nineteen Years, investigated by comparing 1826 with 1845.—The days of New and Full Moon for the Year exhibit an analogy in the interval or periods of days to the interval of Recurring Periods.—Dr. Samuel Horsley's investigation of the Weather-Influence of the Moon.—Schubler, Pilgrim, and Flaugergue's investigations of the same.—Volney's opinion.—La Marck's Weather Almanac, published a year beforehand, giving the Winds, Temperature, etc., for each Northern and Southern Aspect of the Moon.—Herschel's (so called) celebrated Weather Table, published 1803, calculated from the Moon's position, and the Weather to be produced thereby.—Mr. Orlando Whistlecraft's Weather Table, as deduced from the influence of the Moon at the Four Quarters.—Mr. Whistlecraft's days of Change of Weather for 1857, as deduced in part from the influence of the Moon at the Four Quarters.—The Critical Days (so called) of the Recurring Monthly Periods are not the days of Change of Weather, but the extreme states.—What is Change of Weather?

Digitized by Google

Digitized by Google

CHAPTER VI.

ON THE INFLUENCE OF THE MOON ON THE BAROMETER.

Greenwich Observatory Abstracts, 1845, *page* 33.

"The general fact of a daily lunar tide is indicated by the mean readings, increasing from 6h. W. to 6h. E., and diminishing from 2h. E. to 6h. W., hour angles respectively.

"It appears that the mean height of the barometer is increased by the moon's position in south declination.

"When the moon was at or near her mean distance, and particularly when coming nearer to the earth, the mean height of the barometer was greatest.

"It would seem that the mean pressure of the atmosphere was greatest when the moon was about fourteen days old."

Such are deductions from the most careful observations by those qualified to form an opinion, and from which I presume some effect of gravitation is produced upon the atmosphere by the moon, but the quantities are so extremely small as to escape ordinary observation. Moreover, they are so mingled up with the other predominating actions, as to require the most delicate

Digitized by Google

analysis to detect. We are the more obliged to those who undertake such difficult problems, the extreme amount being only the six-hundredth part of an inch of the mercurial column of the barometer. Leaving such minutiæ for future inquiry, as they have no practical bearing, I proceed to the generally received and popular opinion of the influence of the moon upon the weather. What is it? has never been satisfactorily answered; but people look to the change of the moon effecting a change in the weather, with as much certainty as they look to a dial to know what o'clock it is. The weather changes and the moon changes, and they are satisfied, and all is right—the thing is certain, and proved to a demonstration. No one can deny the fact that the weather is very frequently changing, and the moon too, and if we take in a day or two before, and a day or two after each change, then it is a perfect and complete theory, which accounts for all the occurrences.

Such, however, are among the most vague of all popular errors. The moon may, or may not, have an influence on the weather; the question has never been proved on either side, and it remains as undecided as it ever was. When the tables of the recurring monthly periods were laid before an eminent and talented person, his first and almost immediate impression was, that the moon had the presiding power. The very circumstance of the monthly occurrence indicates, from the name itself, some connexion, but still there is very great difficulty in establishing the fact, and the matter is by no means plain.

Digitized by Google

The Greenwich Reports, abounding with such minute and accurate observation and research, supply all the materials for investigation that can be required; but they only advert to the influence of the moon upon the barometer, implying almost as much as if it were the effect of gravitation. But the tables of the recurring monthly periods display facts upon a much larger scale, so large as to be obvious to all; indeed, they are the largest exhibited in the meteorological registers. They embrace the maximum and minimum, and, therefore, comprise the whole circle of facts. They present an order, or recurrence, of the same days or dates; but with the same, or with reverse, states and conditions of the atmosphere. There is no uniform effect, although a regular recurrence or succession of days.

"Influence of the Moon on the variable Pressure of the Atmosphere, on the Temperature, Winds, and Rain." —Such is the heading of a chapter in Mr. Howard's "Climate of London," so that we cannot attach the exclusive belief of the moon's influence to the people only. The Greenwich Observations sanction the idea of some lunar tide; but Mr. Howard, who was an intelligent and long continued and faithful observer, says (page 155, etc.):—"A clue is furnished to the chief difficulties, by the fact, now sufficiently ascertained, that the atmosphere is subject, like the liquid ocean, to the influence of the moon's gravity; and that from this cause, operating jointly with the sun's attractive power, it has *its tides and currents*, and I was induced to cast my reports on the weather into the form of lunar

Digitized by Google

periods. I shall not undertake to give the theory of the lunar tides in the atmosphere. Indeed, what I have hitherto learned respecting them appears to constitute but an imperfect glimpse of this difficult subject, which will now possibly claim the attention of men duly qualified to investigate it, to whose service the materials found in these volumes (which constitute a greater store than I can pretend to use) are cheerfully dedicated."

Mr. Howard's first observations were made in the year 1798, on the variations of the barometer in connexion with the lunar phases, by a series of curves on a graduated chart. When the year had been completed on my charts, I gave an account of the subject to the Askesian Society, which met at the house of my friend, William Allen, in London ; they were favourably received and published by the Society. In above thirty out of fifty lunar weeks, I perceived a coincidence of the greater elevations of the barometer with the moon's first and third quarters, and the greater depressions with the new and full moon. But these were exceptions sufficiently decided to forbid this coincidence being taken for a general rule. The case was indeed sometimes *reversed*, so that a low barometer coincided with the quarters, and a high one with a new and full moon.

I came to the conclusion that the rule obtained chiefly in moderate and settled weather, and exhibited the regular lunar tides ; but the stormy, frost, or thunder, exhibited such a mixture of tides and currents as belonged to a perturbed state of the atmosphere.

The years from 1786 to 1797 were selected for

Digitized by Google

inquiry, and Mr. Howard found that—"The barometer is depressed about the tenth of an inch from either of the quarters to the full and new, and elevated in the same proportion by her return to the quarters. The curves of temperature are less striking than those of the barometer, but which indicate equally the existence of a system of variations governed by the moon's attraction (163) as a secondary cause."

"The influence of the moon on the temperature and density of our atmosphere, appears to be exercised chiefly through the medium of the winds, which is a secondary effect of her varied attraction." (168.)

The death of his dear friend, Silvanus Bevan, in 1819, terminated Mr. Howard's laborious researches into the influence of the moon, which completely puzzled and confounded him, as she has done all previous and subsequent inquirers to the present date. In fact, we have not advanced in the slightest degree, and have no certain data respecting the assumed lunar influence. No person devoted more time, or was better qualified for the examination of the subject, than Mr. Howard, and whoever wishes for information may refer to his work, where the subject is very extensively treated of.

He has a chapter, "Of the Probability of a Communication of Heat betwixt the Earth and the Moon by Radiation." It is possible that the full moon, with a surface intensely heated by the sun, may radiate a portion of the heat to the earth. On the contrary, at new moon, her cold surface being opposed to us, she

Digitized by Google

may receive heat by radiation from the earth. And this concludes the vague and unsatisfactory account of his very extensive labours.

But there is another part of the subject which requires some notice, which is the lunar cycle of nineteen years, when she returns again to the same position at the same time. Hence, if she has such influence over the weather as assumed by some, then it is natural to expect that the period of nineteen years would bring the same weather. But no such state occurs, and by the comparison of the year 1826 with that of 1845—both of which years I have given in order that such evidence may be afforded as to satisfy any inquirer—the case is not proven, and the lunar influence is purely conjectural, the evidence is on the negative side, or exactly the reverse of where it should be. So great is the conceit on this matter, that there are lunar tables for calculating, or rather foreseeing, the weather for any indefinite period from the time at which the moon changes; so certain and sure is the event deemed, and this completes her sovereign sway.

Mr. Luke Howard subsequently published the following work, embracing two cycles of eighteen years, from 1805 to 1841: —"A Cycle of Eighteen Years in the Seasons of Britain, deduced from Meteorological Observations, made at Ackworth and London."

There is something peculiar in this idea of eighteen years, and throughout Mr. Howard's extensive series of research, there is much in favour of the monthly recurring periods. As I have particularly pointed out,

Digitized by Google

the characteristic of the recurring periods being often a reverse state, and not necessarily the repetition of the same weather upon the recurring monthly periods, so likewise by fair judgment the recurring period of the years need not be limited to the precise year, but the years may have a small range of one or even two years on either side the mean of nineteen years. Hence it is rather singular that Mr. Howard should find eighteen years to be the cycle. And moreover, as we find very frequently in our epitome of the years we have given, that the monthly periods which agree even to the day, yet so completely differ as to exhibit reverse conditions of the instruments, and consequently of the weather.

This appeared to Mr. Howard in his investigation and seemed to puzzle him, and very much to thwart his favourite idea of the lunar influence, and he referred such to a perturbed state of the atmosphere. The great Diana seems to have lost all her influence over stormy weather, which is very much in favour of her power being, like her mild and sweet aspect, altogether very gentle. She is very lovely and does not like storms or thunder. And so far this agrees with the popular opinion of a change of moon, and a change of weather, without any precise idea of what that weather is to be. The same phase or condition of the moon does not produce a recurrence of the same weather, if one full moon produces fine weather; the next full moon may reverse it to wet weather. But then again, however favourable the recurring monthly periods may be to the supposed influence of the moon, it is contradicted by

Digitized by Google

the days of recurring periods not occurring at the changes of the moon. Although any one section or series of the critical days may agree with the moon, it is very soon terminated, and another day takes its turn. So that the critical days, which are the positive expressions of the weather, appear to be totally independent of any known influence of the moon. The critical days appear not to follow the order of any given day for more than three or four months, the series being interrupted, broken, and apparently capricious in this respect.

But whatever day is the one of any month, the order of its repetition is regular, and limited to the mean of thirty days, being the period of its recurrence, and such a conformity to the lunar period is a very remarkable and significant fact, and still remains an unsolved problem.

The inquiry involves a much larger range, for the recurring days are not limited to the action of the mercurial column in the barometer. The thermometer, the most delicate and sensitive of all instruments, and only indicating the temperature at the very spot it occupies, this exhibits likewise the recurring monthly periods, and the recurring days of the barometer and thermometer very rarely accord, for they occur on different days, oftentimes several days apart. And if we refer the recurring periods of the barometer to the influence of the moon, to what are we to refer those of the thermometer? This complicates the question and renders it difficult of solution, upon the lunar

Digitized by Google

hypothesis, for this would assign some new and unknown action of the moon, if she becomes the regulator of temperature, and has the power of transferring the heat, and giving it a locality and an abiding place. We cannot admit such an idea at present, until more certain evidence is adduced. And it does not become us to be positive in any opinion where there is such large amount of apparently conflicting facts.

The table of the Metonic Cycle on page 160 looks very funny, and the days of the changes of the moon are quite in keeping with those of the recurring monthly periods in respect to the interval, as in 1845:—

Full Moon.	January 23.	Recurring periods, barometer	21+
,,	February 21	,,	22—
,,	March 23	,,	21+

The interval adopted in the recurring periods is not greater nor of wider range than the days of the changes of the moon, from the one to the same phase, as from 21 to 23, from 21 to 19, or from 17 to 15, or from 4 to 2, or 2 to 4, which are the days affixed to the changes, or even from 1 to 30, as in September new moon. Hence, so far as the interval of two days is concerned, there is nothing contrary to that of the moon herself.

But the recurring monthly periods are not continuous, the series breaks off altogether; but in the lunar cycle they would be much more continuous, as is very evident, and consistently displayed in Mr. Whistlecraft's monthly prognostications.

Digitized by Google

THE METONIC CYCLE, OR LUNAR PERIOD OF 19 YEARS,

in which the Moon returns to the same place on the same day. The days of the New and Full Moons are taken from the Nautical Almanacks.

1826.				MONTH.	1845.			
NEW MOON.		FULL MOON.			NEW MOON.		FULL MOON.	
D.	H.	D.	H.		D.	H.	D.	H.
7	21	23	12	January ,,	7	19	23	2
6	12	22	0	February ,,	6	6	21	18
8	4	23	10	March ,,	7	18	23	8
6	21	21	19	April ,,	6	7	21	19
6	14	21	3	May ,,	5	21	21	3
5	5	19	10	June ,,	4	13	19	11
4	18	18	19	July ,,	4	4	18	8
3	7	17	5	August ,,	2	19	17	1
1	17	15	17	September ,, ,,	1 30	9 22	15	10
1 30	3 13	15	9	October ,, ,,	30	11	14	21
28	23	14	4	November ,,	28	23	13	12
28	10	13	23	December ,,	28	10	13	6

Digitized by Google

I have given the evidence of the days of highest and lowest barometer and thermometer as fixed or assigned by the authorities at Greenwich, in order that they may be compared with the days of new and full moon from the Nautical Almanack, for 1845.

The meteorological coincidences of 1845 with the new and full moon were as follows :—

Full Moon	23rd	January	21st	Highest Barometer.
,,	21st	February	22nd	Lowest Barometer.
,,	23rd	March	21st	Highest Barometer.
,,	17th	August	19th	Lowest Barometer.
,,	13th	December	12th	Highest Barometer.
New Moon	4th	July	4th	Highest Barometer.
,,	1st	September	1st	Highest Barometer.

The approximate coincidences within the limits of the recurring periods were seven in number, five of which occurred near the time of full moon, and two only about new moon. The thermometer displayed only four, but they were more exact.

New Moon	7th	January	6th	Highest Thermometer.
,,	6th	April	6th	Lowest Thermometer.
.,	28th	December	30th	Highest Thermometer.
Full Moon	13th	December	13th	Lowest Thermometer.

It is rather remarkable that, as usual, the thermometer differs so much as to exhibit the reverse action to the barometer, the new moon being the most influential.

In this short notice of the effect of the new and full moon, in producing specific states, as indicated and recorded by the faithful testimony of the instruments, we readily perceive that the full moons of January, February, March, follow on recurring days of those

Digitized by Google

months. We likewise perceive how beautifully and regularly the recurring monthly periods obey the lunar influence. But in the three months which thus follow each other in succession, there is a perfect accordance between the days of the full moons and the days of the recurring monthly periods. So far all appears right, but we have a reversal of the states of the barometer. The full moon of the 23rd of January was attended by highest barometer on the 28th. But the full moon of the next month, February 21st, was attended by the lowest barometer on the 22nd of February, being a totally opposite state. But on the 23rd of March, at full moon, it returns again to that of January.

In respect to the thermometer, the new moon of the 7th of January had the highest temperature of the month on the 6th, which is in direct opposition to Mr. Howard's idea of the new moon being necessarily the coldest, in consequence of her cold surface being in conjunction with us, as the months exhibit no recurrence of the same weather at the same phase or condition of the moon, so we have no reason whatever to expect that the lunar cycle of nineteen years should produce the same kind of seasons in the recurring years of the cycle. We therefore need not be surprised to be told that 1826 and 1845 exhibited completely reverse states and conditions of their respective seasons. In fact, they were not at all alike, but rather the opposite to each other in every respect. But this is no argument whatever against the existence of the lunar influence, seeing that opposite conditions of the weather exist at

Digitized by Google

two or more succeeding full or new moons. But 1826 and 1846 approximate very much more; they were glorious years of heat and sun, and that would only be within the fair cycle of years, allowing some range on either side of nineteen years. But, however, to investigate the subject, would require more documents and patience than I possess. Seeing that there is no accordance upon the monthly states of the moon, it is needless to proceed to the larger series when the smaller one fails so completely.

I have long tried, and very patiently endeavoured to prove, by the most faithful and unremitting observation, the lunar weather-influence in the monthly periods and the cycle of years, but have not perceived any approximation to that effect. Sometimes it delighted me, then it grieved me, and destroyed my hopes and labours; and though I gaze with delight on the moonlight scenery, and enjoy her gracious presence, and love to see the clouds drift over her beautiful face, and veil it, yet I failed to put faith in her smiles. She sports with the clouds and decks herself often with a halo and corona which becomes her as Queen of Night; and then she looks so lovely, enthroned in the heavens, as to be an object of admiration.

> "As when the moon, refulgent lamp of night,
> O'er heaven's clear azure spreads her sacred light;
> When not a breath disturbs the deep serene,
> And not a cloud o'ercasts the solemn scene;
> Around her throne the vivid planets roll,
> And stars unnumbered gild the glowing pole.

Digitized by Google

O'er the dark trees a yellower verdure shed,
And tip with silver every mountain's head;
Then shine the vales; the rocks in prospect rise,
A flood of glory bursts from all the skies.
The conscious swains, rejoicing in the sight,
Eye the blue vault, and bless the useful light."

HOMER: *The Iliad.*

Dr. Samuel Horsley, bishop of St. David's, and a scholar of the first rank, who produced an edition of Sir Isaac Newton's works, with commentaries and separate dissertations, undertook to examine the question of the Lunar Weather-Influence. He says:—

"A popular persuasion of the moon's influence has, somehow or other, gained credit even among the learned, without that strict empiric examination, which a notion, in itself so improbable, so destitute of all foundation in physical theory, so little supported by plausible analogy, ought to undergo. The vulgar doctrine about this influence, is that it is exerted at the new and full, and the first and third quarters; and for three days before and after each of those epochs. There are, therefore, twenty-four such days in each month, over which the moon is supposed to preside. Hence, as more changes must fall within the time, it is evident therefore that people may deceive themselves in this respect. Dr. Horsley examined the meteorological tables of 1774, as published by the Royal Society, and out of forty-six changes of weather in that year, only ten of them occurred on the days of lunar influence, which are two less than belong to them on the even chance. And of these ten changes on lunar days, two

Digitized by Google

only coincided with the new moon, and none at all with the full."—*Horsley in the Philosophical Transactions*, 1775.

The lunar month, of $29\frac{1}{2}$ days, is divided into four quarters, each on an average of $7\frac{3}{8}$ days. In 1830, M. Schubler investigated the subject most carefully, for a period of nineteen years, extending from 1809 to 1828, and divided his tables into the four lunar quarters, from which he inferred that there were more rainy days in the second quarter of the moon than any other, and fewer in the fourth. The first half of the lunar month is more rainy than the second.

Schubler, Pilgrim, and many other diligent and faithful observers, have pursued the subject for a series of years; but which tend in no degree whatever to confirm the common opinion that a change of the weather takes place *at* or very near the changes of the moon. All the observers were aware of this common opinion, which is far beyond the Christian era, so that, had any thing approaching to a verification of it occurred, it would have been readily detected and recorded. Hence they conclude it to be a vulgar and a common error.

M. Flaugergues, at Viviers, made a most extensive series of barometric observations from 1808 to 1828. The result appeared to be that, when—

	MILLIMETRE.
The Moon was farthest from the earth, bar. was highest	755
,, nearest the earth ,, lowest	754
Difference	1

or about the four-hundredth part of an inch.

Digitized by Google

This statement, however, is directly contrary to the Greenwich Observations for the year 1845, under the direction of the Astronomer Royal—

When the Moon was nearest the earth, bar. highest		29·729
,, farthest from	,, lowest	29·726
	Difference	·003

or about the one three-thousand part of an inch.

These eminent men, therefore, differ so completely, and the quantity is so extremely minute, that it may be regarded as a very small effect indeed, and almost inappreciable by general observers.

Reasoning from the analogy of the tides, says Volney, it has been said that, since the moon is the cause of the ebbing and flowing of the ocean—since it exerts a pressure on the liquid surface of the globe — this cannot take place without the intervention of the atmosphere, which consequently must also have its flux and reflux, and hence a complete theory of the winds. But it is impossible to perceive any immediate or sensible action of the moon on the general system of winds. The aërial ocean, spherical as the globe itself, its undulation, if it have any, rolls over its surface, and the vast atmospheric wave flows smoothly on. If the winds depended on the moon, they must be correlative to its phases, like the tides. Of the changes of weather prognosticated in the almanacs every quarter of the moon, fifteen out of twenty are wrong, and it would not be surprising if they succeeded more frequently; and astronomers acknowledge that the period of nine-

Digitized by Google

teen years, which brings back the same positions of the moon, does not bring with it the least resemblance in the course or succession of winds. Mr. La Marck was so convinced of this lunar influence, that he published a Meteorological Diary, predicting, a year beforehand (1789), the winds and temperature which the northern and southern aspects of the moon should produce. He established the negative truth, that the weather was totally independent of the moon.

The following table, ascribed to that most illustrious astronomer, Dr. Herschel, is taken from the "European Magazine," vol. lx, page 24 (1803). It is constructed upon a philosophical consideration of the attraction of the sun and moon, in their several positions respecting the earth, and, confirmed by the experience of many years' actual observation, will, without trouble, suggest to the observer what kind of weather will most probably follow the moon's entrance to any of her quarters, and that so near the truth, that in very few instances will it be found to fail.

NEW OR FULL MOON AND FIRST AND LAST QUARTER.	SUMMER.	WINTER.
Hours of Change.		
From 12 at Noon to 2 P.M.	Very rainy	Snow or rain.
,, 2 P.M. ,, 4 ,,	Changeable	Fair and mild.
,, 4 ,, ,, 6 ,,	Fair	Fair
,, 6 ,, ,, 8 ,,	Fair if wind NW.	Fair & frosty if NE.
,, 8 ,, ,, 10 ,,	Rain ,, S.W.	or rainy if S.W.
,, 10 ,, ,, Midnight	Fair	Fair and frosty.
,, Midnight ,, 2 A.M.	,,	Hard frost unless S.
,, 2 A.M. ,, 4 ,,	Cold with showers	Snow and stormy
,, 4 ,, ,, 6 ,,	Rain	,,
,, 6 ,, ,, 8 ,,	Wind and rain	Stormy and rain if
,, 8 ,, ,, 10 ,,	Changeable	W., Snow if E.
,, 10 ,, ,, Noon.	Frequent showers	Cold with high winds.

Digitized by Google

The nearer the moon's entrance to any of her changes is to midnight, the more fair the weather is in summer; the nearer to noon, the less fair. The moon's time of change, from four to ten in the afternoon, may be followed; but that is mostly dependent on the wind. Her changes at all hours after midnight, except the two first, are unfavourable to the weather; the like nearly may be observed in the winter.

Such was the table compiled sixty years ago, and based, it is said, upon the experience of many years. We have had ample opportunities of verifying it, and knowing all about the weather. Although the table is ascribed to the celebrated Herschel, that has been positively disavowed and denied by Sir John Herschel, and there is no authority for it whatever, except the popular desire to foster it upon some great name.

It still retains its hold and authority upon the public by a power far greater than all the Herschels', and as long as the moon lasts, or continues to shine, she will continue to exercise her sweet control over the mind, as over the skies and clouds.

My kind and intelligent friend, Mr. Orlando Whistlecraft, who is a most diligent and faithful meteorologist has, from his long acquaintance with the subject, and devotion to it, published, in his "Weather Almanack for the Year 1857," at page 28, a weather table, as deduced from the moon's influence at the four changes, being precisely the same as the one I have given. His almanack has been well and deservedly received, and it contains a considerable amount of useful information,

Digitized by Google

with many nice observations and kind reflections. As an author he is well known and esteemed.

We have, therefore, a long roll of years of antiquity, down to the present time, all testifying to the influence of the moon upon the weather. Is all this opinion wrong? The public, or popular authority, has not proved or demonstrated the fact, but boldly assert it. While the scientific world—the eminent and learned—have not disproved it, although they have not approved of it, except in some few instances. The question is still in abeyance. Whatever may be the merits or demerits of the lunar influence, it positively bespeaks recurring monthly periods. There seems to be some alliance between the lunar influence and the monthly recurring periods. If the lunar theory is correct, the monthly recurring periods must be so; but the recurring monthly periods do not of necessity establish the lunar influence. I will just dot down, from Mr. Whistlecraft's "Weather Almanack," the days of change of weather of 1857.

MONTHS.	RECURRING PERIODS.			
January	5	..	23	..
February	..	16	23	..
March	3	15	..	28
April	..	14	23	..
May	..	15	..	28
June	7	..	21	27
July	7	15	..	27
August	7	..	24	..
September	..	17	23	..
October	..	17	24	..
November	..	..	23	..
December	..	..	..	..

Digitized by Google

Here is evidently a long array of recurring monthly periods or dates, assigned to and dependent upon and deduced from the changes of the moon. It must be borne in mind that the critical days of the recurring monthly periods are not the days of change of weather, commonly so called; but the recurring monthly periods are the highest and lowest states of the instruments; they are, in fact, analogous, in some degree, to the time of high and low water. They are, in some degree only, days of change; but they are more properly the fixed, settled conditions of the weather, whichever way that may be. Thus, the 11th of February, 1845, would be the result of the continuance of some days' previous cold, and not the day of change to that extent. Because the days of highest or lowest barometer are not attained generally at once by a sudden transition.

In respect, however, to the value of the lunar weather table, its extreme accuracy as to the effect of two hours' difference in the time of her changing, should produce such difference in the weather, seems very remarkable; and this precision as to the small amount of time producing such great effects, is scarcely to be received. And in respect to change of weather, it may seem rather odd to ask what is really meant by change of weather, for that is at present a very undefined state. Are we to consider a change of wind, or temperature, or from wet to dry, etc., because some of these are changing very much almost every day? Until we have some well defined condition, we are in the dark, and each may be always right or wrong.

Digitized by Google

CHAPTER VII.

Important effects of the Wind.—Action of the Wind on Barometer and Thermometer.—North and South Winds.—Sea and land Breezes of the Tropics.—Causes of the sea and land Breezes.—Gravity or weight, the force or pressure producing motion.—Horary motion of the Barometer.—All-controlling power of the sun.—Lunar influence inappreciable.—Diurnal heating and cooling of the Air.—Diurnal oscillations of the Barometer.—Motion of the air produced by heat.—High pressure at the verge of the Tropics.—Barometer at Macao and Havannah.—Barometer at Madras and Bombay.—The trade winds.—Inclination of the trade winds to the Ecliptic.—The power of the sun in the Tropics.—Cool winds in the Tropics.—The temperate and changeable Climates.—Prevalence of the warmer winds.—S. W. winds characteristic of our climate.—Gulf stream of minor influence.—S.W. winds transformed into N.W. winds.—Prevalence in upper regions of a N.W. current.—China may be the origin of our N. E. winds.—China and England reciprocate.—In the winds two conditions co-existent.—Passage of the S.W. gales northward.—Greenwich and Orkney Barometer.—Orkney a suitable station.—The Barometric Pressure regular and progressive.—S.W. gales, supposed course and termination.—Results of the Anemometer at Greenwich.—Proportion of the Winds.—Preponderance of the S.W.—Deficiency of the S.E.

Digitized by Google

Digitized by Google

CHAPTER VII.

THE WIND.

HAVING attempted to ascertain the lunar atmospheric influence by stating the evidence as given by diverse authorities, and as well as we could the coincidences of the changes of the moon with the recurring monthly periods, thereby inferring that, if the moon did act in the manner stated by those who entertained a favourable opinion of her influence, then it followed, as a necessary consequence, that there must be recurring monthly periods. The lunar periods are well known, and the accordance of the recurring monthly periods of the barometer and thermometer lend the aid of a demonstrable and conspicuous fact to the supposition that the moon may have some secondary, subsidiary, or regulating agency.

But we must carry our investigation a little further before we unhesitatingly assign this controlling power to the moon. There is nothing more obvious to common

Digitized by Google

observation than the great effect the wind has in respect to the weather; in fact, it seems almost to constitute the weather and to be the sum and substance of the whole. It is the visible and palpable motion, it wafts the clouds and bears them on its wings. It is warm or cold according to the quarter from which it comes; it is rough or calm at its pleasure; in most instances it has a specific character as to wet or dry.

The instruments likewise bear the most unequivocal testimony to the influence of the wind in the tables wherein the winds are affixed to the indications of the instruments, and their regularity is very apparent. The periods of highest barometer are mostly connected with the northerly winds, and lowest barometer with the southerly winds. The highest thermometer generally with southerly winds, and the lowest thermometer with the northerly.

Such the meteorological tables uniformly display, as a general principle. The wind, therefore, appears to be the great and essential element of the weather, and to comprise within itself the leading characteristics. What then is the wind? Whence cometh it, and whither does it go? Its cause and consequences constitute the principal part of meteorology.

As the barometer and thermometer exhibit recurring monthly periods, and these instruments are so much influenced by the winds—are the winds themselves in any degree periodic? They are proverbially deemed so fickle and inconstant, that to be as changeable as the wind is even a term of reproach. Unless we can assign some

Digitized by Google

principle of order to the winds, all that we have hitherto said is in vain.

It will be most accordant with nature to regard the winds under a two-fold character of north and south, because they are permanently distinctive, and have a reference to fixed portions of the globe, as the equator and the poles; whereas east and west are shifting points, and have no permanent residence or abiding place. They are merely conventional. From east to the west-by-the-north are the northerly winds; from east to west-by-the-south are the southerly ones. The polar winds are the colder and the denser generally. The equatorial or southerly winds are the warmer, rarer, and moister. The east and west are adjuncts, and have a secondary character, varying in different places.

But let nature speak for herself and be her own expositor. The first and most simple example we can adduce will go far to explain the whole matter, and unravel the mystery. The ephemeral winds of the tropics, or the land and sea breezes, admit of such clear demonstration as to leave no doubt upon the subject, for their constant and regular recurrence at stated hours, and their limited range, and their opposite quarters of the compass from which they blow, although uniform in their direction and course as respects the land and sea from which they are so correctly and appropriately named.

The two surfaces of land and water are unequally treated by the action of the sun's rays during the fore-

Digitized by Google

become warmer than that over the sea, and it ascends as the heated air does up a chimney. The cooler and the heavier air from seaward comes rippling the surface and rushes on the shore a fresh and grateful breeze.

It continues to blow with renewed force during the afternoon, flags as the heat of the day decreases, and dies away at sunset, showing its dependence upon the orb that gave it birth. The night is calm and tranquil and often sultry. Soon as the early dawn of morn appears, a light and gentle air begins to come from off the land—at first very weak and feeble—till, gathering strength, it attains a little power about seven or eight o'clock, endures only for a few hours, and about nine or ten is gone. It is much weaker than the sea breeze. Day after day these are repeated at the same hours. These little winds are great blessings. The sea breeze is so much esteemed as in some places to be called "the doctor," for its salutary effect, and by all persons it is enjoyed for its refreshing coolness. The land breeze, although less valued, is still important.

Independent of the enjoyment and luxury, there is an immense utility, for, since in the tropics, the trade winds blow constantly in one direction, the harbours on the coast would be almost useless without these alternating breezes. If the trade winds blow home upon the coast, the harbours, of course, are always free of access. But how are the ships ever to get out again, if the wind is permanently against them, especially if the harbour's mouth is very narrow, and

Digitized by Google

the heavy ever-rolling surges of the sea, impelled by the wind, prevent their exit? The sea and wind against them, they would be wind-bound, and imprisoned. But behold the beautiful provision! for every harbour, whether on the wind-ward or the lee-ward side, have a fair wind *in*, and a fair wind *out*, every day in the year.

This may seem too poetical to be true. Let us see how it is accomplished, and take as our hand-book the valuable tables in the "Greenwich Observations," at page 66 of the introduction, which gives the weight of a cubic foot of air under a pressure of 30 inches of mercury, at all temperatures from 0 to 90. The air over the land in the forenoon becomes heated to 86°, while that over the sea remains at 80°. Now,

	GRS.
A cubic foot of air and vapour at 80° weighs	505
,, ,, 86° weighs	498
Excess of weight of the colder air over the sea	7

Hence the inevitable result is, that the heavier air rushes in upon the lighter and warmer.

During the night the land air cools to 76° and the sea air remains nearly unaltered.

	GRS.
A cubic foot of air at 76° weighs . . .	510
,, sea air at 80° weighs . .	505
Excess of weight of the cooler land air .	5

Hence the same inevitable result. The weight of the heavier air rushes in upon the lighter, and produces the land breeze; but as the difference of the weight

Digitized by Google

is less than that of the day, so is the land breeze shorter and feebler.

This heating and cooling process of the air, in either case, is very limited in respect to altitude; and likewise in extent of surface, it is altogether to be regarded as a local effect, partial, and circumscribed within narrow bounds. In islands of any moderate size, which present a sufficient quantity of land, the sea breeze is blowing from all quarters of the compass; hence, there is no general action over any extent. These breezes are examples of the law which pervades the whole system of the winds, that gravity or weight is the force—in which expression by the word *force*, I mean pressure producing the effect of motion—and that this force follows the law of the inverse square of the distance, *i.e.*, that the same force at half the distance will be four times the strength.

The wind is the great, visible, and sensible effect of the power, motion, and force of the air. It represents two states or conditions of the atmosphere, just as much as a flowing stream of water, or the current of a river, denotes generally its descent or fall from a higher to a lower level.

The wind is the result of a force, or greater pressure, at its source or origin, than at the place into which it passes, or where it ultimately terminates. The place from which it comes, and the place to which it goes, differ in the respective weights or density of the atmosphere.

I have endeavoured to demonstrate, as an absolute

Digitized by Google

fact, that the action of the sun causes the land and sea breezes. The monsoons are land and sea breezes on a larger scale, and are dependant upon the position of the sun. The trade winds shift their place somewhat, and vary in their extent, strength, and action, from the same cause or power.

The diurnal oscillation or horary motion of the barometer in the tropics, and the regular progression of the motions of the column at different periods of the year are manifestly and demonstrably due to the all controlling and pervading influence of heat, and leave no doubt as to the mighty power of the sun in all these cases. We perceive such a manifest coincidence, and such recurring and repeated results, as to produce almost a spontaneous acquiescence, and which the strictest scientific investigation ratifies and confirms to its fullest extent.

The declination or position of the sun causes and determines the wet and dry season of the tropics, and, in some portions of these regions, we perceive how the winds waft the vapour, and carry the clouds on their wings to either the Malabar or the Coromandel coast, in a very marked and peculiar manner.

The specific character of the winds is such, as almost of themselves to constitute the weather and the seasons. Such is the case in the tropics, and such is the case with our own country. One instance only may suffice. We have a cold or a mild winter, as a S.W. or N.E. wind prevails; the S.W. wind is moist and warm, the N.E. cold and dry, in general. As

Digitized by Google

the sun regulates, causes, and rules the winds, clouds, and rain in the tropics, does he do less in other parts of the atmosphere? Undoubtedly not. One great cause, the sun—one great agent, heat—have the sole control, and we cannot relinquish the supremacy of the sun, or delegate its power, or transfer its influence in these respects, until we obtain such decisive evidence in favour of the moon, as to justify us to dethrone the sun, and install the moon as queen of heaven and the ruling power of the weather. A law more powerful and fundamental than the Salic law excludes her from the throne, for even her best and warmest friend, Mr. Howard, who spent nearly his whole life in her service, with great zeal and devotedness, ingenuously acknowledges that she has no power or influence over the winds, and he transferred the case as a legacy to posterity. Her own advocates fail to establish or uphold her power over the weather.

There is a point which her friends always adduce—that, as she causes the tides of the ocean, so she must act on and through the atmosphere. Admitted. But it acts by the power or force of gravitation, and that is in proportion to the mass acted on. The weight of the whole mass of the atmosphere is a mere fraction, or unit, compared to the mass of the waters of the ocean. And on the ocean's bosom — on her wide expanse of waters—there is scarcely any perceptible tide, so slight, indeed, as to require the most delicate observation to detect it. The cases are by no means analogous in any respect whatever, and the wonderful

Digitized by Google

uniformity and strict adherence to time and recurring periods of the tides, is one of their most striking and permanent characters. We can depend upon the tides; they are regular and obedient to the moon,

> "Whom ocean feels through all her countless waves,
> And owns her power on every shore she laves."

If the moon acts by the force of gravitation, the whole superincumbent column would be acted on, if we experience its effects at the base. But it does not appear that such is the case, for there are contrary currents and opposite conditions, frequently prevailing in the same vertical column, and the barometer does not fall equally at the same time throughout.

Any acting force that had a power of condensing the air, at any given area, whether simply mechanical, or by gravitation, would, of necessity, by so condensing the air, produce an evolution of heat, and thus transfer it to some distant area. The very accumulation of a mass of air on the summit of the atmosphere, producing a crest or lofty ridge, and thus forming undulations of the surface like the tidal waves, is capable of producing the like effect. For there is not any clearer demonstration than that the mechanical condensation of air is attended by the evolution of heat. The whole question at issue is simply, whether the condensation from some unknown power is the first act or cause, and the evolution of heat the necessary consequence or result; or whether the locomotive power of heat, by its first

Digitized by Google

area; and the air which has parted with its heat becoming condensed, as a necessary consequence, both being simultaneous acts. The results would appear to be the same, and there would seem to be but little difficulty in adopting either hypothesis, as, to a certain extent, they both accommodate themselves to the facts. But as air does not condense itself, but requires some mechanism or force, what is that force or power supposed to do so in the atmosphere? Is it the moon that produces a tidal wave on the surface? I think not.

As nature delighteth not in a multiplicity of causes, and as difference of magnitude constitutes no disparity of essence, these breezes are the key to the whole phenomena of the winds. They embody the principle, they display the cause to be, as was said of old by Job, that "he made a weight for the winds."

To these ephemeral and strictly local breezes the barometer scarcely answers or records their presence. But it is not two different surfaces only that may be unequally heated, the atmosphere itself is subject to the same diurnal action of heating and cooling. This process likewise is more particularly confined to the tropics, and gives rise to the horary oscillations of the barometer, or its period or diurnal movement, ascending and descending regularly.

THE THERMOMETER IS

At 7 A.M.	The lowest .	73°
2 — 3 P.M.	The highest . .	83°
8 P.M.	A second minimum .	79°
4 A.M.	A second maximum .	74°

Digitized by Google

THE BAROMETER IS

The highest	at 9 A.M. . .	29·93
The lowest	3 — 4 P.M.	29·83
A second maximum	10 P.M. .	29·89
A second minimum	4 A.M. . .	29·81

The preceding table of the hourly heights of the barometer and thermometer at Bombay are from Thomas Hopkins, Esq., "Philosophical Magazine," April, 1847. He justly says that the barometer falls by the expanding power of heat on the vertical column, by removing or transferring a part of the material of the atmosphere.

"Humboldt states the diurnal oscillations are felt throughout the tropics, even at the altitude of 13,000 feet—that they are two atmospheric tides of somewhat unequal duration, being $6\frac{1}{2}$, 6, 6, and $5\frac{1}{2}$ hours. And all observations hitherto collected have not indicated (he says) a sensible influence of the moon on the oscillations of the atmosphere; but that these oscillations appear to be owing to the sun, as the highest barometer nearly coincides with the coldest part of the day, and the lowest barometer with the hottest."

"It has been said that so regular are these movements that they indicate the real time within a quarter of an hour, that it is constant at all seasons, on the plains, on the mountains, and in the cities. The existence of two ascending and two descending but unequal tides is established beyond all question, and if not altogether undisturbed by storms, hurricanes, or rain, yet they are never suppressed in the tropics, the mean daily

Digitized by Google

oscillation of the barometer being ·111 part of an inch."—*Colonel Sykes.*

These hours of the thermometer and barometer conform to the times of the land and sea breezes; the same cause produces both. The obvious and direct tendency of this diurnal and periodic motion is for the air to follow in the course of the sun. In fact, it is the motion of the air itself that affects the instruments, which reveals to us operations of which we should otherwise be ignorant, and indicates that the lower stratum of the atmosphere becomes rather more affected by the diurnal temperature than the upper. It is in every respect analogous to the sea breeze, only more extensive in its effects and action, and range of altitude, and extent of area. Thus the air follows the course of the sun from east to west in the tropical regions. There is a warmer and a cooler period, a consequent higher and lower pressure, in the course of every twenty-four hours. The instruments denote to us, in this case, very plainly the extent of the atmospheric areas, which are six hours apart, giving a wide and extensive range to these operations, and showing the magnitude thereof. They encircle the globe and have a periodic action of hours—paroxysms, and remissions, but a continuous movement, with epochs of maxima and minima. It is to this influence that I am disposed to attribute the easterly direction of the regular trade winds.

We are accustomed to regard the winds as fickle and inconstant, but these are permanent and regular; they scarcely ever deviate much from their natural course—

Digitized by Google

N.E. in the northern topic, and S.E. in the southern. They blow steadily and briskly, and are mostly the charming and beautiful winds which waft the ships across the ocean. What is the cause of these permanent winds?

There is nothing like a theory; it satisfies all the requirements, for it is only the exponent or expression of the facts—a concise formula which embraces a multitude of circumstances, genera and species alike. In the sea and land breezes, and in the horary actions of the barometer, I have adhered to the principle of gravity, as being a force or pressure producing the effect of motion. Keeping this in view, where are we to find the permanent cause of the constant and never-ceasing trade winds?

At the verge of both the tropics, in latitude 22° or 23°, we have a part of the line of high pressure to which I have so frequently adverted. Macao, Canton, and the Havannah, at the boundary of the northern tropic—and at Rio Janeiro, on the edge of the southern tropic—all proclaim by the barometric tables the beginning of a zone of high pressure; the mean barometer of the year being at all these places 30·11 inches. All the authorities I possess give the same result. While the mean barometer of the tropics is only 29·98, leaving a permanent difference of ·13 inch, equivalent to a pressure of nearly 10 lbs. upon every square foot.

Digitized by Google

The following Table of three years' observations at Macao, lat. 22° north, long. 113 °east, by the Abbe Richenet, is accurate and good, and a type of the series. It may be compared with that at Havannah; they both agree in the resulting high pressure at the verge of the tropics.

MACAO—LATITUDE 22° NORTH.			HAVANNAH *from* HUMBOLT.		
BAROMETER.	MONTHS.	THER.	BAROMETER.	MONTHS.	THER.
N.E. 30·34	January	68	30·24	January	57
·30	February	65	·26	February	59
·26	March	66	·32	March	58
S.E. ·11	April	71	·35	April	62
Monsoon ·11	May	74	·39	May	64
29·96	June	81	·34	June	73
·96	July	83	·22	July	74
·99	August	83	·16	August	75
N.E. 30·15	September	80	·12	September	73
Monsoon ·19	October	78	·08	October	64
·28	November	72	·12	November	62
·35	December	62	·08	December	55
30·17		74	30·17		65
70 Inches of Rain.			The Havannah table is not correct I believe, but it is the best I have—it is only approximate.		

The Tables of the Barometer at Madras and Bombay, by Colonel Sykes, in the "Transactions of the Royal Society, 1850," exhibit very accurately the barometric pressure within the tropics; and the series altogether comprise a vast amount of useful information.

Digitized by Google

MADRAS, LATITUDE 13° NORTH, ON THE COROMANDEL OR EAST COAST.		MONTH.	BOMBAY, LATITUDE 18° NORTH, ON THE MALABAR OR WEST COAST.	
MEAN BAROMETER.			MEAN BAROMETER.	
	29·99	January	29·92	
	·97	February	·88	
	·86	March	·83	
	·80	April	·81	
	·71	May	·66	
	·66	June	·65	S.W. Monsoon
	·69	July	·66	and
	·72	August	·73	Rainy Period
N. E. Monsoon	29·76	September	·77	76 inches.
and	29·87	October	·84	
Rainy Months	29·94	November	·88	
44 inches.	30·10	December	·96	
Mean	29·91		29·80	Mean

The evidence is clear and decisive, that outside of the tropics is a zone or belt of high pressure, and that in the tropics the barometer has a lower mean throughout the year.

The inevitable result is that the force outside presses on the tropical air, just as much as that a heavier body sinks in a lighter fluid, or that a light body rises in a heavier fluid. What then can be the result, but a continuous flow of air from the northern and the southern edge into the tropics? and this combining the equal influence of the horary diurnal oscillation of the barometer, amounting to ·11 part of an inch, giving the easterly direction; from the two-fold causes come

Digitized by Google

the N.E. and the S.E. great and regular trade winds.

But the trade winds are subject to a shifting and to a variation in their extent and force. The Bay of Bengal will afford an illustration of what I believe prevails throughout the tropics, viz.—the wind being always from the coolest quarter. In the beginning of the year the N.E. monsoon, fresh and cool, blowing from the frozen platform of central Asia, in December, January, February, etc.

As the sun crosses the equator, and begins to heat the land over that of the sea, the S. and S.W. monsoon begins to blow about April. The temperature is 95° in the shade, and the refreshing sea breeze, or S. and S.W. monsoon, cools the air. From 15th July to 15th October the air is like a vapour bath.

The N.E. monsoon begins in October, and continues till March or April, the temperature always giving the direction to the wind, and that always being from the coolest quarter.

These monsoons are only large land and sea breezes, precisely the same in principle, but of longer duration. The cooler air is always the denser, and proceeds from the point of higher pressure, whether the case be small or great.

I think it appears indisputable that a very gracious provision pervades the atmosphere of the tropics. In these heated realms, these sunny regions, the greatest benefit is a cool refreshing breeze, and the wind is, I believe, almost always, as a general principle, from the

Digitized by Google

coolest quarter. The land and sea breezes, the trade wind from N.E. or S.E., and the monsoons, shifting with the season to the coolest quarters, all are alike in origin and in action.

The horary oscillations of the barometer in the tropics, show that it always is the lowest about the warmest part of the day, or two or three o'clock.

The state of the barometer in the different months in the tropics give precisely the same result—the barometer having the lowest mean in the warmest months—as in June, July, August—at Madras, Bombay, Calcutta, etc., etc.

The tables of Madras and Bombay are very important, and admit of many deductions; one I may mention—how small an influence the rainy season has upon the barometer, its height being the same in the two localities, the one with great rain and the other without any for the time. An investigation into these conditions would soon exalt meteorology very considerably, and give it a practical bearing.

In the tropics the winds are regular, and periodic, and recurring. The ephemeral have appointed hours at which they recur. The monsoons obey a period, and come and go at stated times. The great system of trade winds, which pervade the tropics, follow the sun in the path of the ecliptic, with an inclination nearly coincident therewith, and are swayed by the impulse of his mighty rays. Thus all are as one—united in a system—with one effect and one intention, to soothe the feverish heat, and to refresh the languid frame with the heavenly boon

Digitized by Google

of cool air. The glorious orb that sheds his powerful beams upon these glowing realms of life and beauty, leads in his train the zephyrs and the breeze, to fan the nations of the teeming earth. Here he reigns supreme, but holds his delegated power from heaven. Heat and light are in their utmost intensity. But the light is different from the continuous light of the polar climates. The tropic light is not well adapted for photography, at least, it does not succeed so well, and it has some peculiar properties. At Melville Island no vapour was detected in the winter months; here it abounds and spreads it blessings round the world, where water else could not be found.

Here the power of heat to raise the steam from the deep abyss is prodigious, and millions of tons of water are lifted up daily by the sun from the tropic seas, then spread as beautiful clouds upon the face of the sky, and are wafted by the winds to water the earth, to bless it with flowers and fruits, and nourish all flesh, which is but as grass. But this vapour, these clouds, are the scenes of delight, when decked in their beauty by light, and at morning and evening their hues they display as they cling round the sun. Their tints salute the early dawn, and herald forth the orb of day, with all the colours which in the rainbow play. Then at his setting they are the fair attendants, and spread their charms of such exquisite perfection, as if it were a gleam from heaven. Thus every moment, as he rises and he sets, he is encircled by a halo of transcendant glory, and spreads these continual scenes to delight and gratify the

Digitized by Google

nations of the earth, and proclaim the visible presence of Him at whose first call the early morning broke.

> "And none can look upon that throne of fire
> Upon which, perchance, some spirit sits, and keeps
> An awful reckoning with our earthly sphere.
> For the great Eye that sees us never sleeps;
> It has its ministering angels, wheresoe'er
> Existence is; beneath us, and above,
> Around us, and within us—He has there
> His delegates."
>
> SHAKESPEARE.

Now leave the tropics, and, homeward bound to England, come and see what winds and breezes blow, and from whence they come. The sun is not our idol here; we greet his presence always with delight, and revel in his warm and cheering beams. We have left him in the tropics, but still bespeak his praise, and love his glorious rays, although clouds surround his throne and veil him often from our sight.

It appeared a somewhat easy task to tell all about the wind, where there seemed to be order and regularity. But here, where the wind shifts about from day to day, where the barometer runs up one day and tumbles down another, and the temperature varies, sometimes twenty degrees in a day, and a perfect chaos seems to prevail in the elements, it is a matter of very considerable difficulty to have a correct idea. All this is so well known as to be a by-word and a proverb, and our climate is incorrectly regarded as the most changeable. I hardly know how to approach the subject, it is such a tangled tissue,

Digitized by Google

With deference and humility I bespeak the kind forbearance of my readers, to whose judgment I submit my thoughts. The S.W. winds are our most frequent and common winds, and, therefore, I will take them first in order. In them we perceive the contrary principle to that of the tropics, for our S.W. winds are warm and balmy airs, flowing into a colder region; they come to warm us in the absence of the sun, and bring us on their wings some portion of his heat, so that they are glad messengers. They oftentimes prevail for many weeks in November, December, and January, and constitute those mild and grateful winters we so much prize. They come with healing on their wings, and are as the balm of Gilead to many weak and suffering invalids, whom the piercing cold would soon transfer to "that bourne from whence no traveller returns."

The mean barometer of the year at Madeira .	30·11
The mean barometer at London . . .	29·918
Difference or excess of weight at Madeira	·192

—which is equivalent to a pressure of 14 lbs. upon the foot. The mean barometer of London is deduced from the "Greenwich Observations"—Howard and Daniels—and the error must be very slight, as the whole of the series extend over a lengthened period.

Such being the case, we have a force existing in the Madeira parallel, which produces the frequent S.W. winds. I have before shown that Madeira and England are responding and corresponding stations, reciprocating and alternating with each other very frequently, and that

Digitized by Google

a sympathetic action exists between us; but that the preponderating influence and power resides at Madeira, so that we receive more than we send, that is, we receive more S.W. winds than we send back to them in N.E., because our barometer is not so frequently above theirs, as theirs is above ours. The balance, therefore, is greatly in our favour. Nor can we fail to admire, at least, we ought not to cease to be grateful for that arrangement and ordination of events which yields us such great and inestimable benefits. Take away the majority of our S.W. winds and give us N.E. instead, the whole face and condition of our dear island would be altered and transformed, and we should scarce know it, and our loss would be irreparable.

And it is upon such a small difference, and that at a distance from us, that our benefits and advantages depend —so much are we bound up in a community of goods with others. What would Egypt be without the rains in Abyssinia? and so would England be without the higher ridge of pressure in the Madeira area. The S.W. winds bring us those gracious rains which clothe our soil with almost perpetual verdure. Let us adore the gracious Being who gives these blessings, and is ever mindful of all his creatures. Some have been disposed to assign our unusually mild or mildest winters to the approach of the great Gulf Stream, whose tepid waters traverse the Atlantic, and almost reach our shores. But of what benefit would that stream be if the cold and arid N.E. wind prevailed? It would be powerless, useless. Our severer winters are marked by the prevalence of the

Digitized by Google

N.E. winds; and who causes them to blow and stays the S.W.?

But what is the Gulf Stream, great as it may be? why does it not warm Newfoundland? I have no desire, and certainly no necessity, to undervalue any benefit which nature bestows; but I cannot for one moment admit any derogation of my praise of the truly "Great South-west Current" of air, which comes with its canopy of clouds, fraught with warm vapour, sailing along the firmament, and bounding over the dancing billows with music and with inspiring glee. It comes like a mighty train, rushing along at the rate of twenty miles an hour, 2000 or 3000 feet in altitude, and with a breadth of 100 or 200 miles. Surely it is a grand spectacle—it is a wonderful operation; and how soft and warm and mild—sometimes almost like a steam or vapour bath. This derives nothing from the Gulf Stream; it leaves it far in the rear, to wend its way slowly through the ocean.

We have a demonstration from whence they come, but whither do they go as they pass onward? However swift they fly, they cannot reach the pole, but from the natural configuration of the globe, and by great circle sailing, they gradually veer to the westward, and turning over, as it were, as they approach and traverse the polar circle, ultimately attain the maximum latitude, gracefully curl, and become N.W. winds, and descend again in other distant regions.

I think our S.W. winds traverse the northern parts of Russia, cross the higher latitudes of Siberia, and

Digitized by Google

descend as N.W. winds of China, which are cold, dry, and piercing, and analogous to the N.W. winds of Canada and the United States, whose N.W. winds are the offspring of the S.W. winds of the Pacific.

Such are the suggestions I have to offer on the progress of our S.W. winds, and which ultimately reach the latitude of 30° the area of high pressure, and from which they originally started, only in different longitudes of about 120° or 130° east. Here again they are impelled from the S.W. across the Pacific, toppling over the arctic regions of America into the Atlantic again, and thus complete them.

This may be said to be purely visionary, but not exactly so, for we have some circumstantial, but not demonstrative evidence. It has been said by Mr. Green, the most celebrated aëronaut, and who has ascended more times than any other person, that a perpetual N.W. current prevails in the upper regions. It is so frequent as to be almost a permanent trade wind. It is evident the S.W. winds cannot reach the pole, and if a south wind goes direct to the pole itself, and traverses the very point, it immediately becomes transformed into a north wind. The polar regions may be said to be the axis of the winds, or the turning ground, in which they change their name and direction. The N.W. winds are very frequent there. Few persons can fail to have observed the very frequent appearance of spreading sheets of cirrous expansions, thin attenuated linear cirri, converging to a point in the N.W., and spreading out like a fan, towards the zenith area. These are very lofty,

Digitized by Google

and seem to denote some current or pervading influence there. They are as vanes, pointing out the direction of the wind. Perhaps the change of the S.W. into N.W. winds in the polar regions may have some share or connection with the aurora; the N.W. quarter appears to be its favourite residence, but this is ideal. That there are frequent northerly currents in the upper regions is well established, as the following exemplifies:—

"Mr. Green, junior, the aëronaut, at Frankfort-on-the-Maine, being engaged to ascend in his balloon on Sunday, 22nd August, 1847, notwithstanding a violent hurricane from the S.W. was blowing, attended with tremendous thunder and lightning, he nevertheless ascended, 5 P.M., immediately beneath a charged cloud, and when at about 4,500 feet elevation, was on a level with the storm clouds, which were pouring down their rain like a waterfall; each discharge from the clouds caused a vibratory motion in the balloon. He soon ascended above the storm, and a fine breeze from the N.W. carried him free of the scene."—*Morning Chronicle, Saturday, 4th September*, 1847.

The next wind is the opponent of the great S.W., and in every respect the reverse, the N.E. or the Siberian wind, coming from the colder regions of the earth, dry and arid. If the S.W. came from a distance, whence comes the N.E.? I am disposed to regard the atmospheric actions to be performed on a grand scale, and not a little petty local area, every one its own autocrat.

As I transferred by degrees the S.W. wind into a N.W., and passed it downward even to Pekin and the

Digitized by Google

coasts of China, so I am disposed, by parity of reasoning, to look there for the origin of our continued N.E. winds. I mean those which blow sometimes for several weeks. The N.E. wind is a frequent spring visitor, comes with our birds of passage in April and May, and stays some little time with us. As I have supposed that we transferred our warm S.W. winds to China, under a widely different phase to what we had them, so China may return the compliment in a similar manner.

In April and May, the vast continent of Asia, embracing the whole of China, becomes heated by the presence of the sun, and a tendency to easterly winds. S.E. prevails, and this influence is continued through Siberia. The S.E. winds become in their turn N.E., as they traverse the more northern portions, and reach us after their transformation. I think the source of the great easterly winds are from this part and principle, but I have no document to establish the fact, and only surmise such may be the case, the cooler air from the Pacific Ocean flowing in upon the more heated land. I may, however, mention two facts recorded by the persevering and eminent horticultural traveller, Mr. Fortune.

"The winter of 1844—45 was so remarkably mild at Shanghae, that the usual supply of ice from the ponds and canals could not be procured."

I need not refer the reader to our epitome of 1844—45, the winter of which was severe and very protracted.

In his second journey to the tea districts he speaks of the winter of 1848—49 being particularly severe, and that in January, 1849, the thermometer

Digitized by Google

descended to 17° of Fahrenheit, and the cold was of the most severe and piercing nature.

It is somewhat more than remarkable that January, 1849, which was so severe in China, as at Shanghae, lat. 31°, was so very mild in England as to be cited by me, in the first chapter, as one of the instances of cold winters in one area producing warm winters in another. For January, 1849, was one of our mildest months, all the spring flowers adorning it and the birds singing (*vide* first chapter for account of it). These two instances from Mr. Fortune exhibit both winters, as exhibiting a reverse action in China and England.

The winter of 1848—49 was unprecedently severe in North America. I am inclined to believe that the seasons very often accord in America and China, theoretically I should assume such to be the case. I have a solitary observation which I may as well record from Mr. Fuss, at Pekin, to Sir David Brewster, in the "Edinburgh Philosophical Journal."

1832.

March 8th, at midnight, highest barometer at Pekin 30·54
7th, lowest barometer for the month at London 29·40

While speaking of the winter of January, 1849, it was deemed a very remarkable one at Maderia, being the coldest remembered for a great number of years, so that most persons were glad to avail themselves of a fire. The multitude of scattered independent facts, all tend clearly to one point, and are unanimous in their testimony. China and England may reciprocate, although apparently remote.

Digitized by Google

Having shown that south winds may become north, while the east and west winds always continue to preserve their direction, and are not convertible into each other—they may encircle the globe and run for ages round it without altering. The southerly winds are the only convertible ones in our hemisphere. In the cooler and cold climates there is a tendency for the air to flow from the warmer quarter so as to give the benefit thereof.

In all the investigations I have pursued, one principle appears to pervade the whole, and two conditions always to be coexistent—a maximum and a minimum. These are inseparable states, invariable and universal in all the atmospheric phenomena—whether small or great, local or general. In respect to the production of the winds, there is a cold point and a warm point, a low pressure and a high pressure. In the land and sea breezes, monsoons and trade winds, I have demonstrated these points.

In our own climate, likewise, I have endeavoured to show, from the Madeira tables, that a mean high pressure generally obtains in that parallel, and forces the current of air from that quarter. The abstract from the results recorded by the anemometer at the Greenwich Observatory, give the positive practical fact that the S.W. winds, including those from west to south, are by far the greater majority in number, and have the greatest and most enduring power. Thus all is satisfactory, but where is the other point—the point of low pressure—to be the co-operator with the

Digitized by Google

high one? High and low must be together, though distant; rich and poor are natural associates. As the cold point has lost its temperature, and imparted its heat to warm the other point, so poverty imparts the wealth and power to the rich and great. If the gale blows fresh and strong, whither is it going at such a rattling speed? There must be a way made for it, or it could not be travelling over our heads unless there was some recipient, some space or room, for it to fly into, and, as the S.W. gales blow with some power for two or three days together. I had often been astonished as I watched the clouds scudding along, to know where they were going and what was the cause of such an impetuous rush of air—a vast and mighty stream; and I asked myself the question, What is to the northward of us? And happily I found the question answered by the Rev. C. Clouston at Sandwick Manse, Orkney (lat. 59° and the northern extremity of Scotland, and 500 miles north of London). The "Philosophical Magazine" has for a series of years contained the valuable tables from Orkney, and with earnest expectation I searched for the Rev. C. Clouston's reports and dotted them down on the delineation, with my own observations or those of Greenwich, and, with this accession of valuable information, the subject of the winds acquired fresh interest.

Now the different curves of the barometer at Greenwich and Orkney crossed and re-crossed each other, running up and down without any apparent order. Such was the first and somewhat abiding

Digitized by Google

impression. But time and patience dispelled part of my errors, and gave me a better judgment. By connecting the arrows denoting the force and direction of the wind with the barometric delineation, I perceived what a strict alliance there was between them, and what faithful exponents they were of each other. The evidence was complete.

The barometers at Greenwich and Orkney sometimes were at the same height, the weather being nearly similar. But this was very rare in comparison to their differing conditions. They rose together or fell together; or the one was rising and the other falling; with this remarkable effect:—Whenever the barometer at Greenwich was higher than the barometer at Orkney, a southerly or S.W. wind blew, the force or strength of wind being in proportion to the difference between the two barometers. When the difference amounted to seven-tenths or eight-tenths of an inch—and sometimes it did to as much as an inch—then a strong S.W. gale blew from Greenwich to Scotland; and so delicately sensitive is the barometer, that the moment the barometer begins to rise at Orkney, the breeze begins to slacken, and if, as is sometimes the case, the Orkney barometer runs up quickly and before the London one, then the S.W. gale veers round to the N.W., and blows with more or less impetuosity, according to the difference of the barometric pressure between Orkney and London. At whichever place the barometer is highest, from that place the wind proceeds, and blows into that where

Digitized by Google

the barometer is the lower. So strictly true, and so delicately sensitive is the barometer, which acts like the most refined and accurate balance, oscillating to the smallest alteration of weight, and I believe almost momentarily responding to changes in a distant area. Such appears to be the case between the Orkney islands and London, uniformly and constantly.

Nothing can display the value of comparative observations more than the tables of London and Orkney, and were they kept upon one system, and with scrupulous regard to simultaneous observation at a given time, the whole series of facts would be displayed in a very beautiful manner. Orkney is a very suitable station, and if combined with one at Land's End and the intermediate one of Greenwich, we should obtain very great information. Cork in the west, and Ipswich in the east, would complete the area, and from these five points, by a moderate system of co-operation, the great tissue would be unravelled, and the phenomena of the atmosphere elucidated.

My grateful thanks and special acknowledgments are due to the Rev. C. Clouston for his urbanity and kindness to me, and for his public contributions, which have been a source of great instruction and delight to me. They are among the most valuable documents for comparison with and elucidating the Greenwich observations.

These S.W. gales blow swift and strong, urged by a force at or about the Madeira area, with a difference of barometric pressure between Madeira and London of one

Digitized by Google

inch, and between London and Orkney of one inch more—thus making altogether perhaps, in extreme cases, a difference of two inches barometric pressure, or 144 lbs. upon the square foot, between Madeira and Orkney, a distance nearly of two thousand miles. Is there a regular progression throughout of the pressure, that is, does it decrease in equal ratio for equal distances, so as to be a gale of uniform strength all the way? Or are there inequalities of barometric pressure at equal distances? If so, the gale is of unequal force at the different places.

The equal division would be two-tenths of an inch difference of the barometer for every hundred miles, or 14 lbs. pressure per square foot. An attention to the comparative barometers of Lands End, London, and Orkney, would develope many important points, and perhaps demonstrate satisfactorily that the barometer is the best and truest anemometer; and that a perfect accordance exists between the barometer and the wind.

The S.W. gale having proceeded to the Orkneys, or that area, what becomes of it, since it is ultimately stopped by a counteracting pressure or force to the northward of it, where it meets a resisting power and some opposing wind? The S.W. mounts up and ascends to the higher regions, overtops the N.W. current, which opposes it on the lower ground, and the S.W. floats upon and warms the upper strata of the arctic regions; still urging on its way, is transformed gradually into a N.W. wind, and comes down in that direction upon the

Digitized by Google

coast of China, setting bounds in its turn to an up-current from the S.W. on those shores, and becoming the westerly winds of the North Pacific, and wending its way in a westerly direction, or S.W., on the western coasts of America—blowing soft and warm, as at Vancouver's Island to the northern regions over which it passes, and become again a bleak and rough N.W. to the United States, into the Atlantic, across which it may wend its way in a westerly direction till it gains again the parallel of the ultra zone, or that of high pressure, from which it started, and where we took it at Madeira.

Having thus made a circuitous route and performed different offices, but never having lost its westerly direction, that I believe is an approximation to the condition and action of this our S.W. breeze, until it comes back again to us as warm and fresh as before. By this great operation the balance of force is maintained, nothing lost, nothing gained. These are the systems of winds outside the tropics, and each perform a circuit of the globe within their own domains, and do not intrude upon or interfere with each other. I do not in any degree intend to limit the origin of S.W. winds at Orkney to Madeira. I have only regarded these as stations for the purpose of example. The stations of highest and lowest barometer are migratory and varying, but it was convenient to have some fixed points for examples. The same explanation and reasoning will apply to the S.W. winds, wherever they originate.

The highest barometer may be in England and the

Digitized by Google

lowest barometer at St. Petersburg or that area, and Madeira not at all implicated, but still the principle, the effect, action, and cause of the S.W. remains the same. I have imperfectly sketched the ideas I entertain respecting the prevailing winds of our climate.

RESULTS AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1845.

OSLER'S ANEMOMETER.		MONTH.	WHEWELL'S ANEMOMETER.	
WHOLE SUM OF PRESSURE.	WHOLE NUMBER OF HOURS.		WHOLE DESCENT OF PENCIL.	WHOLE NUMBER OF MILES.
LBS.				
418	202	January	114	4320
160	141	February	89	3373
572	308	March	135	5116
421	266	April	127	4804
312	208	May	109	4131
269	162	June	85	3221
215	172	July	83	3145
277	228	August	31	1174
315	186	September	102	3865
167	154	October	107	4055
285	187	November	128	4861
655	313	December	145	5495
4066	2527	Total	1255	47564

There were 4110 hours calm in the year during which the instruments recorded no pressure.

The motion of the wind corresponding to the descent of the pencil of "Whewell's Anemometer through one inch is equal to 37.9 inches." Introduction (page 76) to "Greenwich Observations."

Digitized by Google

The diligent and accurate observations at Greenwich, and the laborious abstracts or summary reports, involving a large amount of time and talent, entitle them to be ranked in the highest order of meteorological research. From them we learn that—

	NO. OF MILES	NO. OF HOURS	AVERAGE SPEED PER HOUR
			MILES
The S., S. W., & W. winds amounted to	27865	1589	19
The E., N. E., and E. N. E. ,, ,,	7085	310	20
The N. N. W. and N. W. ,, ,,	6247	336	19
The North ,, ,,	4737	237	19
The S. E. and E. S. E. ,, ,,	1636	80	20
Miles in the Year	47570	..	..

—which give an average amount of wind for every day in the year of 130 miles, supposing it extended over the year. But as Sundays and holidays were exempt, the observations are not perfect, and especially as 4110 hours during the year were calm, or so that the instruments recorded no sensible motion of the air, we have to make a large addition. As the wind is recorded for only 2527 hours, we have to make that the division. And the result gives 451 miles, as the current or stream of air when the wind blew continuous for 24 hours.

The average rate or speed of the wind is 18·8 miles per hour from the preceding abstract; but much remains to be done in order to perfect our knowledge of the winds.

The first fact that ostensibly presents itself is the large amount and preponderance of the S.W. winds,

Digitized by Google

being considerably more than all the rest together, bringing us warmth and vapour from the bosom of the Atlantic, about or belonging to the Madeira area.

The second in the series is their counterpart, and being only one-fourth of the number of the S.W. They are the E. and N.E. from the St. Petersburg or Russian area.

The extremely small number of the S.E. is very peculiar, blowing only 80 hours in the year, showing that we do not hold very frequent atmospheric intercourse with the Holy Land or the Jerusalem area, the reason of which is not apparent, but which requires special investigation.

The easterly winds blew an extraordinary number of hours without recording any pressure, Osler's anemometer not noting any under $\frac{1}{4}$ lb. pressure on the square foot. The easterly winds, therefore, were extremely gentle for the most part. And a remarkable contrast to the slight and unfrequent S.E. is that of the N.W., which only blew 11 hours in the whole year without recording a pressure, and that for the given number of hours it blew its recorded pressure is relatively greater than the S.E. These are obvious upon the inspection of the tables.

We may very fairly consider the winds of vast importance when we review these facts. The tables of figures are not mere dry abstracts; but are the representatives of the events and circumstances carried on in the operations of the atmosphere, and in themselves supply abundant materials for thought, reflection, and

Digitized by Google

delightful contemplation, each according to his own peculiar bias. See how beautifully the winds decline in summer, when the earth is heavily laden with its bounty and riches, and the foliage is dense. Surely the wind is tempered by the hand of heaven, and guided and restrained. It is a thought dear to the heart, to recognize such pleasing manifestations in everything—nothing forgot, nothing overlooked. The same superintending power presides in all things, and the largest amount of beneficence pervades the whole. Everywhere the same desire to gratify and delight the heart of man, who loves the God of mercy, the Fountain of all wisdom, and of all goodness; who, indeed, knoweth our necessities before we ask, because all things are provided for us beforehand, and long before our necessities need them. Nor should we fail to observe and note the concurrence of the small range of the barometer in the three summer months, with the gentle winds of summer, and their small amount—almost implying a connection between the two—and affording strong circumstantial evidence that the amount of weight, as denoted by the barometer, is the controlling agency of the winds; the adjacent areas, likewise, being so adjusted as to equalize, in a great degree, their force or pressure.

Digitized by Google

CHAPTER VIII.

Meteorological Registration and Delineation.—Delineation of the Daily Observations.—Comparative Observations and Delineations.—Explanation of the Delineation prefixed.—The Barometer at Greenwich and Orkney Delineated.—Connection of the Barometer with the Wind.—Great Exception and apparent Fault.—Importance of Relative Conditions.—The Barometer exquisitely truthful and correct.—The Gale at Greenwich quiescence at Orkney.—Orkney Observations in "Philosophical Magazine."—The Barometer the balance of the Firmament.—Mr. Glaisher on the Storm of January 14th, 1843.—Gale of January, 1845, at Greenwich and Orkney.—Greenwich and Orkney responding Areas.—Value of Delineation for Inspection.—The Delineation displays all the Points.—S.W. Winds flowing into the Polar Regions.

Digitized by Google

Digitized by Google

CHAPTER VIII.

METEOROLOGICAL REGISTRATION AND DELINEATION.

The different methods adopted by each and every meteorologist of recording their observations, is an anomaly among the physical sciences. It bespeaks at once the total deficiency of any recognized order, and the absence of any established principles. And nothing whatever can more powerfully retard its progress, or diminish its influence and reputation with the public, than the Babel-like confusion which pervades the communications respecting the weather. It would seem to be most desirable to establish and adopt some approach to uniformity; for otherwise all the materials for the most part are useless, and admit of no comparison or research whatever—the difficulty and labour is so very great. And no fact whatever is conveyed by many of the contributions, which only overlay the science with a load of figures. Some uniform system of registration, and some established mode of delineation, would greatly

Digitized by Google

advance and enhance the value of labours now almost useless. Without this, there is no co-operation, and the best instruments, and the most accurate observations, and the most diligent attention, fail of any productive effect. "The Times" has most liberally and generously for some years devoted a portion of its columns to the meteorological reports from the Highfield House Observatory, near Nottingham; and the "Illustrated London News" is equally desirous and anxious to extend the favour of a helping hand by giving several contributions from talented observers.

A rigorous adhesion to time—exact time—must be combined with accurate observations and good instruments — an uniform system of registration, whereby the observations are simply recorded without any applied corrections, so that the register of the facts shall be as if they were photographic impressions from the instruments themselves. The altitudes need not be reduced to the level of the sea, but serve more important purposes by being given as they are. It is indispensable, for a correct and practical knowledge, not only to have a table of figures for each day's work, but to have some approved form of delineation, wherein all the observations are laid down, and reduced to a given scale and order. This is the most useful of all, and forms as important a part of meteorology as a map does of geography. A good delineation will display by simple inspection the most conspicuous and leading traits, whereas a number of tables, clustered with figures, are difficult to analyze. There is no reason to doubt but

Digitized by Google

that in a short time we may have maps of the atmospheric areas, which will be great aids in physical geography and in the general study of natural history.

And without some mode of delineation and of registration, meteorology cannot advance in proportion to the labour, talent, and ability bestowed upon instrumental observation. The almost exclusive use of, and dependance upon, the instruments, supersedes in a great degree any observation upon the atmosphere itself, and certainly the apathy and neglect of co-operation is the barrier to improvement. For isolated observations in meteorology are scarcely of any value whatever; they require a comparison with other states in order to comprehend the reason of the conditions of the atmosphere they instrumentally record.

Why a stiff breeze or gentle gale blows for ten or twelve hours and then suddenly lulls—ought we not to search out the reason and discern the cause? It is easy to be learnt. Why not cast off the hermit's mind and associate with others?

The delineation which I have prefixed to the present volume is a comparison of the actions of the barometer at Greenwich and Orkney, places distant from each other about 500 miles, Orkney being in latitude 59°, and about the northern extremity of the kingdom. It is a capital meteorological station, and the Rev. C. Clouston has long been a faithful contributor to the "Philosophical Magazine." I am much indebted to his courtesy and kindness in furnishing me with a correct delineation, and I have long been in the habit of

Digitized by Google

comparing his valuable observations with those of Greenwich, and derived much information therefrom.

It is necessary to say that the black curvilinear line represents the condition of the barometer at Orkney, while the red curved line represents that of Greenwich; the red colour being supposed to be the symbol of the southern or warmer station, and the red colour throughout that of relative warmth; hence, the red arrows are the type of the southern or warmer winds.

The black line represents the northern or colder station, and the black arrows the colder or northern winds. Hence the colours are suggestive symbols of the relative states of temperature. The cardinal points are like those of maps in general, the north at the top, the east on the right, so that the direction of the arrows denote the direction of the winds, and the colour the relative quality as to heat.

The scale is large, to give freedom and ease, at the same time more correctness than a little drivelling miniature. The dots of each day represent the height of the barometer at 9 A.M. on the left hand, and 9 P.M. the right hand dot.

The number of arrows is intended to convey some idea of the force of the wind, considering a calm to be represented by the absence of any arrow, and a hurricane to be represented by six arrows, as deduced from the pressure in lbs. on the square foot. So that the square of any number of arrows will very nearly give the force or pressure of the wind in lbs. on the square foot. "Greenwich Observations," foot note page 5, January, 1845.

Digitized by Google

The barometer is more intimately connected with wind than rain. It falls very little in the tropics for great and heavy rains, but it almost invariably indicates the gale or coming hurricane, whose power and impetus probably depend on the proximity of some adjacent high pressure; like a waterfall or cataract, instead of a gradual fall of the bed of the river.

The delineation I have prefixed, although confined to one month, is a type and emblem of the whole, and may afford materials for much thought, investigation, and research. We cannot fail almost immediately to perceive that whichever coloured line is highest or uppermost, corresponds with, or indicates, the highest barometer at the place which that colour represents.

And it almost invariably follows that the wind arrow is of the same colour as the top or upper line of the barometer of that day, and the moment the coloured lines approach, or intersect, or alter their relative position, the wind immediately alters its power, force, or its direction.

When they approximate to an equilibrium the air is calm; as they recede from each other, and their weights or pressure differ, the wind strengthens and increases in force and power as the barometric lines separate from each other.

It appears from the most casual inspection that the red line almost uniformly overtops or surmounts the black line, and we perceive that the red arrows, or warm winds from the south, generally accompany the red line

Digitized by Google

barometer, the red arrows are south winds. The barometer produces the winds.

On January 13th, there are five arrows, the square of which is 25. In the "Greenwich Observations," about noon of the 13th, the pressure is given at 25 lbs. on the square foot. And in the like manner throughout three arrows would denote 9 lbs. pressure. And one arrow would denote light air from 1 to 3 lbs. pressure on the square foot, according to Osler's anemometer. Of course, the pressure of the wind is not constant throughout the day: the maximum effect only is given, in accordance with the highest and lowest barometer.

The barometer and the wind are natural allies, and associated, as cause and effect, so intimately and closely as scarcely to be dissevered.

The difference of the weight between any two columns of air is the immediate and direct cause of wind, the greater weight, force, or power rushing down upon or into the column or area of smaller weight, the strength, pressure, and rapidity of the wind being in direct proportion to the difference of weight or barometric pressure between the two columns or areas, large or small. The intervening distance between the columns or areas of different weights acts according to the general laws of gravitation. A difference of one inch between the barometers of Greenwich and Orkney, or 500 miles apart, would produce a breeze of perhaps 9 or 10 lbs. pressure, but if a difference of two barometers at 250 miles apart amounted to one inch, the pressure or force of the wind would be 16 or 20 lbs.

Digitized by Google

on the square foot. These are the fundamental laws as true and permanent on the atmosphere as in the celestial and planetary motions. The winds, therefore, most strictly conform to the great and general principle of gravity, and, as Job so correctly expresses, "He made a weight for the winds."

There appears to be one very great exception to the general rule upon which I have endeavoured to explain the phenomena of the winds. On 13th January, it will be seen, the barometer was unusually low, and the wind unusually strong, and that, contrary to the law, the black line being above the red one, by a tenth of an inch or more, at the usual hours of observation; the depression of the barometer at Greenwich at one P.M., being only given for that hour, while the Orkney barometer at noon is unrecorded; therefore we do not know the exact difference at noon between them. But throughout the day the Orkney barometer was higher than the Greenwich barometer, and yet the wind did not blow from Orkney as it should have done; but a very strong gale blew directly contrary, or from the S.W., and this would appear to be a fatal objection to all we have previously said, but the evidence and the appearances are only partial. There was no gale at Orkney; all was tranquil, and a light air from the north-west. See, what a very slight difference in the pressure stopped this mighty impetuous gale rushing onwards with such force and power. The scale was turned, as it were, by a feather, and a limit set to the storm by a gentle force, unseen, unknown, and unrecognised,

Digitized by Google

except by the barometer, which is the balance of the atmosphere, and shows its weight to the fraction of a grain, and no other means existing of perceiving why the wind was hushed, lulled, and checked, and died away into a calm.

The barometer began to rise in the north first, and gradually progressed towards the south, and came up only as a gentle breath against roaring wind, and stayed it. But the delineation to be perfect, and the evidence to be complete, should show where the pressure or the force that urged on the gale was. It was undoubtedly to the S.W., in or adjacent to the Madeira area; there was the higher pressure, I am as fully convinced as if I possessed the tables to demonstrate the fact. My limited access to information precludes the possibility of my exhibiting the deficient testimony, but it assuredly existed; for the Madeira tables of the one year which we possess demonstrate the fact of high pressure at Madeira producing S. W. gales with us. As the barometer began to rise in the north, so it began to fall to the southward of us, as towards Madeira; thus the propelling force was diminished at the very same time that the opposing power was increased.

Exactly resembling in every point the arms of a balance, as the one rises the other falls in exact proportion, and the smallest fraction turns it. Nothing can exceed the mathematical demonstration of the balance; the barometer is the most exquisite balance, and to it we appeal with unfeigned confidence. Its testimony is ever true. Does a balance ever err except it is out of order?

Digitized by Google

Extraordinary observations on this storm were made at Greenwich every quarter of an hour, for two whole days, and the barometer carefully noted; had we a similar production from the north and from the south, we should have the most beautiful and surprising illustration of all the three barometers acting in the most perfect accordance as to time, and each and all answering to the minutest quantity, and the wind being as obedient to the slightest variations of pressure, or resistance, as the most delicate mechanism we know. The zeal of future meteorologists will, I hope, supply this demonstration. The value of the Greenwich observations is impaired by the negligence of others, and the magnificent patronage was not seconded by any co-operation, and, from the apathy and indifference of the public, were discontinued.

The Rev. C. Clouston, in his letter of 4th February, 1843, accompanying the delineation he most kindly favoured me with, says, "You will *observe* we had not the storm that was so destructive in England on 13th and 14th. The barometer was uncommonly low, and the sky threatened a storm." Now here is an important fact. The barometer at Orkney was 28·56 to 28·51, and a light air from eastward, and nothing whatever accompanied the low barometer at Orkney, and consequently the barometer might be deemed useless and in fault, whereas, in England, the barometer being 28·46, a violent storm prevailed. Here is a very strong case and accusation against the barometer, and no abstract reasoning could clear it up. The circumstantial evidence

Digitized by Google

is so very strong and perfectly true. But, behold, the beauty and the power of comparative meteorology, and the whole truth and not a part. Everything appears contradictory, but look at the delineation. The Orkney barometer was higher by one-tenth of an inch than the Greenwich one; the powerful and strong wind at Greenwich, of 25 lbs. pressure on the square foot, could not blow into the Orkney area, because it was met by a greater and resisting force, although small in amount, yet quite sufficient to turn the scale and give the preponderance to the pressure from the northward. Orkney, as it were, laid in the very trough of the depression, but just on the verge or boundary of the northern pressure, and the extreme point of the southern depression. It lay, therefore, peaceful and quiet, nearly in the centre of the balance, or equilibrium, of two opposing currents; and it is worthy of particular notice how delicately and gently the barometer was raised, both at Orkney and London, by the gradual advance of the northern current, whose fierce impetuosity was checked by the gradually retreating power of the great S.W. current, which kept the northern one at bay, and only allowed it to advance by gentle steps. I cannot possibly conceive a finer illustration of the atmospheric actions, nor any more perfect demonstration of the correctness and infallibility of the barometer. It is impossible for it to err; but our interpretations, alas! how lax; and how wide a departure from the truth of nature do they exhibit.

The extreme depression of the barometer at London

Digitized by Google

and Orkney at the same time, and yet with such different results and states of the weather, and their simultaneous and rapid rise of nine-tenths of an inch in twenty-four hours, running up side by side of each other, and mounting up so far above the depression of the previous days, are strikingly exhibited in the delineation, and which might be overlooked in the mere mass of figures as so elaborately given in the "Philosophical Magazine," March, 1843, conducted by Sir David Brewster, Richard Taylor, etc. To that work the public are amazingly indebted for the continued publication of the meteorological observations from Chiswick and Orkney, and from them I have derived the most valuable facts. And those who may wish to avail themselves of the Orkney observations will find them contributed to that work by the Reverend C. Clouston, whose zeal and fidelity I cannot sufficiently appreciate.

It would neither be safe nor prudent for me to have overstepped the bounds by giving more illustrations, else a large body of facts might be elucidated by a more extensive system of delineation. But I am depressed by the expense, which, although small and moderate, is yet relatively great. For the little one I have prefixed, for its elegant manipulation I am indebted to the ability and talent of Messrs. Day and Son, Lithographers, Lincoln's Inn Fields, and am obliged for their undertaking so small an affair. If no one else admires it, I do, as a neat display of a most useful art.

Without a combination and union with the Orkney

Digitized by Google

delineation, it would be difficult to convey precise ideas of the actions of the barometer and its wonderful indications. It is the key of most of the atmospheric states, and almost unlocks the vestibule of the firmament. The more it is contemplated the more it is appreciated, and it is the great teacher of meteorology; it is the foundation and basis thereof; it is a noble instrument, because it is the model of perfection and of truth; an unerring balance which weighs the atmospheric column of whatever height it may be, whether forty-eight or fifty miles, more or less. Although its weight is 14·7 lbs., or upwards of one hundred thousand grains, yet the mercurial column of 30 inches poises it, and turns to a grain difference in the weight of the superincumbent mass—because the mercurial column is not a cubic inch, and but a slender thread.

REMARKS ON THE STORM OF JANUARY 14, 1843.

(By Mr. Glaisher, "Greenwich Observations," page 266.)

The most remarkable meteorological phenomenon that has happened since the establishment of the magnetical and meteorological department of the Observatory is, beyond question, the extraordinarily low reading of the barometer during this storm. The commencement of the storm was almost simultaneous over England, Scotland, and the eastern coast of Ireland, and the remarkable depression of the barometer was general over a great part of Europe. On the morning of the 13th, the readings of the barometer

Digitized by Google

began to decrease rapidly, and the wind began to blow. About 8 A.M. two vivid flashes of lightning and long peals of thunder, at an interval of 20 seconds. During the thunder the fifth-ball electrometer was not affected, and the gold leaf of the dry-pile electrometer was inclined slightly to the magnetic pile, but the *needle* of the galvanometer oscillated from 30° to the division 35° towards A. At 8h. 45m. A.M., the reading of the barometer had sunk below 28·3, and the rapid decrease of ·1 per hour was checked. It, however, continued decreasing, and at 23 minutes past noon the minimum reading took place, being 28·096, a reading lower than has been registered at the Observatory since 1821, December 24th, at 5 A.M., when its reading was 27·89 as registered in the "Greenwich Observations."

1783	March 6th	the reading was	38·22
1809	December 17th	,,	28·20
1821	December 24th	,,	27·89
1824	November 23rd	,,	28·37
1843	January 13th	,,	28·09

All the lowest readings, except that of 1821, occurred at or about noon. The barometer was very minutely observed, and in the gusts the oscillations of the mercury amounted to ·05. The wind was strongest at the minimum reading, and the heaviest gusts preceded the minimum. The loss of life and property was great.

From Lloyd's books it appears 180 vessels were wrecked, 453 persons lost, and a total loss of property

Digitized by Google

preceded by lightning and thunder. The minimum reading occurred first at the southern places, and afterwards at the northern:—thus, at Greenwich at 12h. 53m.; at Cambridge, 1h. 35m.; and Manchester, at 2h.—GLAISHER.

Having thus minutely detailed the circumstances of the storm of the 13th of January, 1843—in which the barometer displayed its faithfulness, although suspected of an error—let me briefly advert to one instance more of its action at Greenwich and Orkney.

I have briefly, indeed far too briefly, adverted to some points of the year 1845—a year of magnitude exceeding most in the importance of its events.

1845				
March 27th, at 9 A.M.,		Greenwich	Barometer	29·67
,,	,,	Orkney	,,	29·24
			Difference	·43

S.W. breeze at Greenwich, pressure of from four to five pounds.

1845				
March 27th, at 9 P.M.		Greenwich	Barometer	29·77
,,	,,	Orkney	,,	29·10
			Difference	·67

S.W. gale increasing.

1845				
March 28th, at 9 A.M.,		Greenwich	Barometer	29·53
,,	,,	Orkney	,,	28·60
			Difference	·93

W.S.W. gale, pressure of eight pounds, and frequent

Digitized by Google

gusts, with nine to ten pounds on the square inch of Osler's anemometer.

1845				
March 28th, at 9 P.M.,	Greenwich	Barometer	29·64
,, ,,	Orkney	,,	29·32
		Difference	·32

W.S.W. breeze, pressure of only one to two pounds, and at midnight nearly calm.

1845				
March 29th, at 9 A.M.,	Orkney	Barometer	29·90
,, ,,	Greenwich	,,	29·86
		Difference	·04

The balance turned, and a N.W. light air, with pressure of half a pound.

I conceive it to be almost impossible to adduce more positive demonstration of the strict alliance between the wind and the barometer. As the pressure between the two places varied, so directly and immediately did the wind, and I believe the action to be *instantaneous;* and provided we had a series of the same delicate observations at other places like those we have at Greenwich, I doubt not, in the least, that the action was quick almost as the electric telegraph. As it is, we have the broad and general fact, and such an approximation as to render the opinion probable. It may be desirable just to advert to the point that the barometer at Orkney, on 28th March, 1845, was 28·60, with a strong S.W. gale there; but January 13th, 1843, the

Digitized by Google

the appearances and indications of the barometer were the same, and yet the results were so widely differing—in the one case a gale, and the other none. The comparison with the Greenwich barometer explains the whole. In March, 1845, the Greenwich barometer was nearly one inch above the Orkney; hence a strong rush of air from Greenwich, or the southward; but in January, 1843, the barometers soon approximated, and the Orkney barometer was highest, hence no southerly breeze or air from Greenwich.

Returning now again to our delineation. It will be found to supply us with ample materials for safe and sound deductions and explanations of many circumstances that occur. I have often been very much surprised, when a S.W. or W.S.W. gale has blown fresh and strong throughout the day, to find it lull and die away frequently at night-fall; and I could not perceive any reason for it, until I had made some collateral delineations of my own observations on the barometer with those which I subsequently received from Orkney; and then, as in the delineations I have prefixed, it will be perceived that the Orkney barometer has a frequent tendency to rise so much more through the day than the Greenwich one, and to approximate each other at 9 P.M. Thus, upon the evening of the 4th to the morning of the 5th, a rise at Orkney and a fall at Greenwich. Again, on the 8th and 10th of January, but particularly so on the 28th and 30th. In these cases the wind was checked more or less at Greenwich, and lulled by the antagonistic rise at

Digitized by Google

Orkney, and the wind more or less altered in its course.

In many cases the veering of the S.W. to W., is caused by the opposing northern pressure at Orkney, which deflects our S.W. to W., and puts it about sometimes completely.

The barometer, when the N.W. wind is coming, rises first at Orkney, and they appear to have more frequent N.W. winds there than at Greenwich.

I could dilate much more upon my humble delineation. The days of highest and lowest barometer do not uniformly accord at Greenwich and Orkney—they may do so, or be reverse states. There are two new moons given in January, 1843. They do not appear to produce the same state of the barometer nor the weather at either place; and so on, throughout each delineation the same differences are exhibited. But every one must judge for themselves.

I have been very particular in stating as my opinion that we owe our mild winters to the prevalency of S.W. winds—arising from a continuous higher pressure in the Madeira area; but that alone would not be sufficient, unless not only we had a lower, but that Orkney had a still lower barometer than Greenwich. The delineation exhibits this part of the fact beautifully, the black or Orkney is almost uniformly below the red or Greenwich. Hence room was made for the S.W. winds to blow into. The Orkney low, and the Madeira high barometer, procure our favouring gales and mild winters.

Digitized by Google

It will be perceived, therefore, we had a vast preponderance of S.W. winds and scarcely any N.W., and those only short. The N.E. were absent, and the mean temperature of January, 1843, was 40°, or 4° above the mean, being a soft, warm, mild month, and the early spring flowers appeared.

The Rev. C. Clouston, in his letter to me, says, that at Orkney, January, 1843, has been very wet and boisterous, and changeable. On the 4th, frequent showers, squalls, and hail showers, and hail so large as to break twenty-three windows on the west side of his house in one minute. And again on the 7th, thunder and lightning, and hail, which broke thirteen windows more—the pieces of hail were one inch in length—ovate or egg-shaped, and were accompanied with much lightning and thunder, which is more common with us than in the "summer."

One question more presents itself ere we close the subject of these S.W. winds. Observing how frequent they are, and from whence they come, and whither they go, we may ask what becomes of their heavy freight of vapour? It is no wonder that Scotland abounds with lakes, and that the northern regions have such copious streams and abundant supplies of water, seeing that these winds come loaded with vapour, and are ever impelled on one side or other towards the polar region, which is the separate condenser of the vast volumes of steam raised in the warm regions, and impelled towards these climates.

Digitized by Google

CHAPTER IX.

The Greenwich Observations the Type of Excellence.—Light, a bright Effusion.—Light, its marvellous Glory and Beauty.—Immense Utility of Light to Vegetation.—Light purifies the Atmosphere.—Organic Matter in the Atmosphere.—Black and Coloured Rain.—Atmospheric Electricity manifested as Light.—Captain Robert Fitzroy on St. Elmo's Fire—Corpus-sant, or Holy Light.—Dr. Franklin's Opinion of the Lights.—Points of Light on Persons, etc.—Lights on Horses' Manes and Ears.—Luminous Snow Storm.—Popular Opinion and Sciences accord.—Aphlogistic Lamp from Electric Light.—Magnetism imparted by Lightning.—Velocity of Electricity.—Atmospheric Electricity, its conditions.—Remarkable order of the Needle.—Recurring Periods of the Magnetic Needle.—The Eastern Declination of the Magnet.—Atmospheric Action in the Eastern Area.—The Electric Lights affect the Magnetic Needle.—Transfer of Electricity analogous to Heat.—Alternate Magnetic States at Hobarton and Toronto.—Equivalent Volumes of the Colours of the Bow.—Light, Heat, and Electricity allied spirits.—The Electro Polar Circle.—A system of Perpetual Transfer sustains the whole.

Digitized by Google

Digitized by Google

CHAPTER IX.

REGARDING the "Greenwich Observations" as the type and standard of meteorological research, and as a general repository of the most valuable facts, I cannot conclude the investigation of the recurring monthly periods of the atmosphere, without endeavouring to follow in the path which the great masters have marked out, and themselves have trodden. For

"The lives of these great men remind us
We can make our lives sublime;
And departing leave behind us,
Footprints in the sands of time.

"Footprints that perhaps another
Sailing o'er life's solemn main,
A forlorn and shipwreck'd brother,
Seeing, shall take heart again.

"Let us then be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labour and to wait."

LONGFELLOW.

Digitized by Google

The atmosphere is a compound of many materials, and is a world within itself. Each department has special and peculiar laws. Not only are there different materials, but likewise three distinct governing, presiding, or resident agents, or acting powers, viz.: light, heat, and electricity. My attention has principally been given to heat, as the agent concerned in the examples which I have adduced of the recurring monthly periods. But light and electricity cannot be excluded, and they remain to be considered.

In respect to light, I cannot introduce it more becomingly than in the bright effusion of Milton:—

"Hail, holy light! offspring of heaven first-born,
Or of the Eternal co-eternal beam,
May I express thee unblam'd? since God is light,
And never but in unapproached light
Dwelt from eternity, dwelt then in thee,
Bright effluence of bright essence increate.
Or hearest thou rather, pure ethereal stream
Whose fountain who shall tell? Before the sun,
Before the heavens thou wert, and at the voice
Of God, as with a mantle didst invest
The rising world of waters dark and deep,
Won from the void and formless infinite."

THIRD BOOK OF "PARADISE LOST."

In the "Greenwich Observations," the action of light is scarcely adverted to, except we regard the actinometer as indicating some feeble and transient effect. But such a glorious subject as light, which illumines the atmosphere, and moreover has such immense chemical and other qualities, which place it in the first rank

Digitized by Google

as an atmospheric agent, cannot be excluded from our consideration.

Photography has of late years produced such marvellous and miraculous impressions as to excite our attention, and will I hope accomplish some delicate and refined instrument or mode of ascertaining the varying qualities and conditions of light.

For even light, subtle as it is, has hourly, diurnal, and seasonal periods, and doubtless recurring monthly periods, but which I have not a sufficient mass of facts to establish.

But with this exemption from the general rule, it is the source of all the beautiful scenery of the sky, of all those lovely colours which adorn the clouds. It forms all the picturesque portion, is the most enchanting and delightful study to all admirers of nature. What can exceed or indeed compare with the beauty of the rainbow, the glory of the sunsets, and their exquisite tints, disposed in the most perfect order of regularity. The scenery of the sky presents some of the grandest pictures from the pencil of nature.

Nor are they without their useful applications in meteorology as signs and indications of the weather, but alas! how seldom noticed. The too sedulous devotion to our instruments prevents our homage at the shrine of nature. I know not a finer field of study than the pictures of the sky.

We are so naturally disposed to consider the sole use of light to be that of bestowing the invaluable blessing and glorious gift of vision, that we rob it of half its

Digitized by Google

attributes. But independent of this, and long antecedent to our sight, it spreads its influence over the universe, and casts its precious beams upon this our earth, through countless ages. For if geologists make any approximation to the truth in their conjectures that the precious and abundant stores of our coal fields are the result of pre-existing forests of almost interminable extent and duration, when nature bloomed and flourished in unknown luxuriance, then it is to light that we owe them all.

For it is a well-established and demonstrated fact that vegetation is as much dependant upon light as on heat. It almost takes the precedence of heat, inasmuch as it is by the actual presence of light that the first act or the initial point of vegetation is accomplished.

Carbonic acid gas is the food of plants, and is furnished to them in part by the rain water, which holds a portion of that gas in solution, as likewise do the waters and the springs of the earth. It is that gas which gives much of the delightful freshness to water, and which when expelled by boiling, the water losing all its air, becomes insipid and flat.

Now, this aërated water being taken up by the plant, the almost instantaneous action of light produces a decomposition of the carbonic acid gas, and the result is the fixation of carbon—the essential point of vegetation—and the evolution of oxygen gas into the atmosphere; a double action, the most important and essential of anything that occurs on the face of the earth. And

Digitized by Google

this is accomplished solely by the agency and action of light, for it in a great degree ceases when the light is withdrawn. Every one may observe how plants love the light—they run to it; in the darkest cellars a ray through the smallest chink attracts them; even in a garden they incline to it.

If the process of vegetation was accomplished by the same means in by-gone ages, then it is to light we are partly and mainly indebted for our coal: the climate is reputed to have been warmer. Strange, indeed, that the heat and light of far distant periods should furnish us with heat and light now, and be among the principal sources of our enjoyments and delights. Well and devoutly may we say—

> "God moves in a mysterious way,
> His wonders to perform."

Another conjecture is among the current thoughts of man's imagination — that the atmosphere, in those earlier periods of the earth's history, was loaded with carbonic acid gas as the necessary source of the carbon of the plants, and that they, the first born, extracted its suberabundant mass from the atmosphere, and purified it for the reception of man, as they purify it for his residence now.

These are mighty thoughts that dare intrude so far beyond our knowledge, but man's imagination loves to rove to realms above. If a much larger quantity of carbonic acid gas did constitute the atmosphere of primeval ages, and was gradually removed, then what objection to the further thought into coming ages

Digitized by Google

looming in infinity? If we burn the coal, and in time, however long that time may be, consume it all, then the carbonic acid gas will be reproduced, and all revert again to its pristine state; and thus, in the grand cycle of revolving time, the great recurring periods of eternity will be accomplished, and with it the transfer of heat to warm the frozen realms of earth and restore their wonted verdure. But leaving these as thoughts which are, indeed, as nought, let us turn to some nearer objects, and to the carbonic acid gas which now exists in our atmosphere.

We have occasional instances of black and coloured rain, which, although given on good authority, is doubted by some. I conceive the probability of such being accomplished by the action of light on the carbonic acid gas, in contact with some minute organic matter diffused in the effluvia of the atmosphere. It is well known that traces of organic matter exist in the rain water, and therefore in the vapour of which that rain consists. Being spread out, and most extensively diffused, and exposed to the full influence of light, a decomposition of the carbonic acid gas is effected in the atmosphere. For any organic matter, as silk threads, filaments, etc., when put in water with carbonic acid gas, and exposed to the sun-light, it is decomposed. There appears, therefore, no reason to limit to these artificial states; and what can be thus performed, nature can more easily accomplish with the same materials and agents in the atmosphere. The carbonic acid gas, being in connection with organic effluvia, is

Digitized by Google

decomposed, the carbon is annexed and precipitated with the rain as a black or coloured substance.

The atmosphere is charged to an inconceivable extent with a multitude of invisible organic particles, as the seeds or spores of fungi, so infinite indeed are they said to be, and so excessively minute, as to exceed almost the capability of numbers adequately to represent. They are stated to ascend or rise at times, like thin smoke, into the air, in countless myriads, and are dispersed in innumerable ways, constituting frequently blights, mildews, etc. In the general way they are the source of mould, mucor, decay, etc.

Now these aërial residents, or atmospheric inhabitants, are nourished and sustained, formed and propagated, by precisely the same materials and agents as vegetation under other circumstances. The atmosphere furnishes carbonic acid gas, moisture, and light; and these microscopic aerides exist, thrive, and live exactly in the same way as the well-known air plants.

The rain, therefore, may at times be more or less coloured, and abound with more or less organic matter and living atoms. The invisible world is far more populous than the visible, and the atmosphere yields to no department of nature in its fecundity.

"There is nothing so slight,
Which in nature sends not forth some light."

QUARLES.

If light was little noticed in the Greenwich observa-

Digitized by Google

reports on magnetism, which takes the precedence of meteorology.

Electricity, although it comes to be considered last, is not by any means the least among the three elements of nature, for it is hardly possible by words to pourtray its attributes. The general way in which electricity is presented to our notice is as light, as a little spark or a falling star; a flash of lightning, or the play of the aurora borealis, or as a ball or globe of light, or as corposants, St. Elmo's lights; these are the usual forms of atmospheric electricity, which seem to have some alliance with light, as far as these manifestations are concerned. It, therefore, comes very naturally to be considered after light.

I shall briefly advert to a few points only, as a volume would not contain the subject, beginning with the corposant—from corpus, a body, sanctus holy—from the religious awe or feeling with which they were contemplated, as being the visitation of some supernatural or holy light. Johnson defines it as a sort of volatile meteor, frequently seen in dark and tempestuous nights about the rigging of a ship.

In the beautiful narrative of the surveying voyages of Her Majesty's ships "Adventure" and "Beagle," 1826, Captain Robert Fitzroy, at page 80, says, "I was a Lieutenant on board the 'Thetis' when her foremast was shattered by lightning in Rio Janeiro harbour, and shall not easily forget the sensation.

"Some of the officers were sitting in the gun room, one dark evening, while the heavens were absolutely

Digitized by Google

black, and the air hot and close to an oppressive degree, when a rattling crash shook the ship. Some thought several guns had been fired together, and others that an explosion of powder had taken place; but one said, 'The ship is struck by lightning!' and that was the case. The fore topmast was shivered, or split into a bundle of long splinters, almost like reeds; the hoops on the foremast were burst, and the interior as well as the outside of the mast was materially injured. The fore part of the ship was filled with a sulphureous smell, and the men thought that some gunpowder was blown up. No person received injury. Only two or three flashes of lightning were seen afterwards; they were followed by loud peals of thunder and heavy rain.

"Just before the rain began, St. Elmo's fire was seen at each yard-arm and at the mast head. Those who have not seen this light—always a favourite with sailors, because they say it only appears when the worst part of the storm is over—may excuse my saying it resembles the light of a piece of phosphorus, or the light of a glow-worm, and not quite so large as the flame of a candle. I was curious enough to go out to a yard-arm and put my hand on a luminous spot, but I felt nothing; but when I removed my hand the light re-appeared."

This is a very excellent illustrative instance, and shows that the light had no heat.

These lights having occurred in the ship in which Castor and Pollux sailed, and from the lights appearing

Digitized by Google

on the caps of the two heroes just as the storm subsided, the lights were regarded as ominous; the heroes were installed into the office of the patrons of sailors. Hence the ancient medals represent each of them with a star, or flame of light, at the *apex* of his cap.

But the Christian mariners subsequently affirmed these lights to be the body of St. Elmo, and on beholding which they chant many litanies and orisons, holding it for certain that in the tempests in which these lights appear, no one is in danger. The great navigator, Magellan, relates that when St. Elmo appeared on the topmast the sailors shed tears of joy. Columbus in the second voyage narrates that "on the night of Saturday, October, 1493, St. Elmo appeared on the top-gallant masts with seven lighted tapers." The celebrated navigator Dampier says: "July 1687, near Macao.—An awful gale from N.E., and dreadful thunder and lightning; about four the storm abated, and then we saw a corpus-sant at our main-topmast head, on the very top of the truck of the spindle. This sight rejoiced our men exceedingly, for the height of the storm is commonly over when the corpus-sant is seen aloft, but when they are seen lying on the deck, and creeping about in the scuppers, it is generally accounted a bad sign."

These lights are very common in the Mediterranean, and when they appear there's a sudden cry of "St. Elmo and St. Ann!" and the awe-struck Sicilian mariners fall on their knees and go to prayer. This Spirit of the Storm, or the Angel of Light, is their tutelar deity.

Digitized by Google

Falconer notices these lights thus :—

"High on the masts, with pale and livid rays,
Amid the gloom portentous meteors blaze."

Dr. Franklin's opinion of these lights is that it is the electric fluid drawing off, as it were, by *points* from the clouds, the magnitude of the flame showing the great quantity of electricity in the clouds ; and if there was a lightning conductor there would be no *lights* on the spindles.

"1749, January 9th. The East India ship Dover, in latitude 47° north, and longitude 22° west; a gale of wind, with lightning and thunder. Sundry very large corpus-sants appeared over head, and settled on the spindles and seemed like large torches. A flash of lightning struck the ship, dismasted her, and stoved the deck, reversed the compasses from north to south, and they wavered about and became of no use. The nails in the binnacle were rendered magnetic, because it was found they caused the other compasses which were afterwards put in to vary."—*Captain Waddell, "Phil. Trans. Royal Society*, 1749."

"1848, December 7th., H.M.S. Rodney, seventy-four guns, was struck with lightning in the Mediterranean ; the iron hoops of the masts were all broken and magnetised. Fire-balls, or corpus-sants, rolled about the deck, and the men ran after them to throw them overboard. Four men were killed."

Large balls, or globes of light, are seen sometimes to roll along the sea, as at the dreadful storm at Teneriffe, November, 1826. In the "Transactions of the

Digitized by Google

Royal Society in 1749," it is recorded that on board the ship Montagu, a large ball of light was seen rolling on the sea three or four miles to windward; it struck the ship, rent the main-mast, and knocked down five men.

Although they are commonly called fire-balls, they are globes or balls of electric light. They are not flame, nor are they hot. They often explode and leave a sulphurous smell, but do not burn. I have adduced these examples, and could adduce a multitude of others respecting corposants, or holy lights, on board a ship.

But similar appearances are exhibited on land. In Cæsar's Commentaries he says—"In the month of February, in the second watch of the night, the pleiades being set about nine at night, a frightful storm, attended with hail of uncommon size, and the points of the javelins of the fifth legion appeared all in a flame, and shone with a spontaneous light."—*African War.*

"October 8th, 1830, Algiers.—During a storm a strong white light appeared on the extremities of all the poles of the tents and pavilions of the French army; and the artillery officers promenading on the terrace were astonished to feel all their hairs stand upright, and light appeared upon the hair. When they raised their hands in the air, a star of light appeared upon the ends of the fingers, and disappeared when they lowered them."

It is related that the night in which Troy was burnt a large light appeared upon the head of Ascanius.

Professor Silliman relates that Mr. Whitney was riding on horseback near Newhaven at night, when a thunder storm occurred, and all at once his horse's ears

Digitized by Google

were tipped with fire; he alighted, but discovered the same appearance at the end of his whip, stirrups, and every prominent object.

The following account of lightning, 1st March, 1774, near Wakefield, by Mr. Nicholson, is published in the "Transactions of the Royal Society, 1774":—"1st March, six P.M. Mr. Nicholson, returning to Wakefield, saw a storm approaching from the N.W. I made haste homeward, but observed a flame of light dancing on the ears of my horse, and several others much brighter on the brass ferule of my stick. Five or six graziers overtook me. They all had the same appearance, and one in particular, who, when he arrived at an inn, called for a candle to examine his horse's head, as it had been all on fire, and he thought must certainly be singed. In twenty minutes it abated, and the clouds divided, except in the N. horizon; about ten degrees high, was a thick cloud, which threw large and exceedingly beautiful streams of light resembling an aurora borealis. There were many falling stars, and at nine o'clock a large ball of fire crossed the zenith towards the S.E. No thunder was heard; a light was said to have appeared on Wakefield steeple."

Numerous instances are recorded of the still bright light on the horses' ears and mane, and the head and neck all covered. The horses' tails are likewise very much affected, and the hairs repelled from each other. It is evident, therefore, from innumerable testimony of such cases, that this form of electric light is not attended with any sensible degree of heat—that the corposants,

Digitized by Google

the globes or balls of light—the lights upon the head, the hair, the fingers, and on horses' ears, etc., are without heat, although presenting the appearance of a flame; they neither singe nor scorch the most delicate substance. In these phenomena electricity stands widely apart from both heat and light, in any of their known properties.

These luminous appearances are not confined exclusively to thunder storms, for there are likewise "luminous snow storms." Professor Lampadius, at Freyberg, January, 1822, during a heavy fall of snow, observed the electrometer to be amazingly affected. There was at the same time a thunder storm at Leipsic. During the fall of snow a phosphorescence, or corposants, appeared at the extremities of the trees along the road. The light was very distinct. It continued even when he touched the tree, but ceased when the brancheswere brought into contact with the ground. It continued for nearly half-an-hour.

In the United States, January, 1827, during a thunder storm, with hail and snow, a luminous appearance was witnessed by persons out of doors. The hats, the gloves of persons, and the ears, manes, and tails of the horses, were all luminous, and the bushes along the road-side were tipped with a vacillating flame of different shapes.

In these luminous appearances, by whatever name they may be called, nature presents us with the effects of atmospheric electricity, or the actions of pointed bodies projecting into electrified air. They perform the office, in a degree, of the lightning conductors, and it is

Digitized by Google

astonishing with what rapidity a small point will discharge a considerable amount of electricity, even at considerable distances. The popular notion of the sailors was perfectly correct and true; their appearance was as the guardian angel, for they performed the office of protectors. No wonder, then, that pious minds became struck with awe and veneration amid the conflict of the storm and the terrific power of the lightning, to see these little quiet and innocent lights supplant the lightning and suspend its action. We may admire their prayers, although it may wear the garb and bear the name of superstition. But these corposants not only show the use of points as conductors, but they likewise seem to teach another lesson—that this ethereal light, or electric lucifer, may be the model or example of the way in which we may use it.

It is so soft, so quiet, and so gentle, that it may be regarded as the type of innocence and purity. It is a lambent, holy light, has no heat, will neither burn nor scorch, has neither smoke nor vapour, and is not even a flame, although it gives a delicate and pretty light. It requires no wick, but merely a point to rest upon. If one corposant quivering on the top-mast of a vessel can be seen from the deck, it is evident there is some degree of light, equal almost to that of a rushlight. Then two or three or more would form a moderate chamber light, and the number might be increased so as to constitute a brush or pencil of light, from several points approximating; and thus become an all-sufficient light for many purposes. Not a great and overpowering and blinding

Digitized by Google

light, which makes darkness visible, and ultimately turns light into darkness, like the great electric light, so called.

This mode of nature's own tuition is soft, mild, and gentle, and admirably suited to our powers of vision. And although it is not yet accomplished, hope leads the way and points to to-morrow.

There is every fair reason to expect the realization of such opinions, and that atmospheric electricity may and will be employed, so as to constitute a beautiful aphlogistic lamp, the realization of the "beau ideal," or the very essence of light, divested of and free from matter. The atmosphere abounds with electricity as the ocean does with water; it may be collected in large quantities; it may be stored up, and applied with perfect safety and advantage for the purposes of useful light, the corposants being the model for our study, and our star of light at night.

Having adverted to the electric light in its quiescent form and stationary condition, and continuing for a time as a lambent flame, I have now briefly to consider electricity in motion, and under widely different characters. In the instances I have already adduced, as in the Rodney, it appears that the iron hoops which were torn from the shivered mast became magnetized. Many cases are detailed in the "Transactions of the Royal Society," of the ship's compasses being completely reversed, the south end turning to the north, and waving about and becoming useless, in other cases the magnetic property destroyed.

Digitized by Google

There are likewise in the same volumes many examples of lightning communicating magnetism, as by Dr. Cookson, 1735:—

"A tradesman at Wakefield, in Yorkshire, having put up a quantity of knives and forks for exportation in a large box, there happened a sudden storm, and a flash of lightning split the box, melted some of the knives and forks, but leaving the sheaths untouched. The owner, on emptying the contents of the box on a counter where some nails lay, the knives immediately attracted the nails with great force, and held them with considerable power, and lifted large quantities of them. The knives and forks were rendered useless from clinging together, and although they were made red hot, yet their power remained still the same when they became cold."

Dr. Bremond relates that a flash of lightning falling on the house of a clock-maker, broke one of his files four inches from the end. On using the broken end of his file it attracted iron very strongly, but this quality resided only at the inside of the file at the broken part. It communicated magnetism to a knife.

Is it not wonderful that a touch of ethereal light from heaven, the mere passage of the lightning's flash, moving with inconceivable rapidity, should communicate a permanent quality and steady action to a mass of iron, and confer upon it the miraculous power of polarity and great attractive force. And all this results from less than instantaneous action, if that were possible, for the velocity of electricity is such as almost to defy the powers

Digitized by Google

comprehension. The following experiment affords some approximate illustration.

A large wheel revolving so rapidly that its spokes are altogether invisible, yet, when illuminated by a flash of lightning, is seen for an instant with all its spokes as distinct as if it were in a state of absolute repose. Because, however rapid the rotation of the wheel may be, the light has come and already ceased before the wheel has had time to turn through any sensible space. And Professor Wheatstone, who is the most able and competent authority, assigns, from some beautiful and refined experiments, a far greater velocity to electricity than to light itself, and computes it to travel, if travelling it can be called, at the rate of half a million of miles in a second, or thirty millions of miles in a minute. Here, indeed, imagination droops, and thought astonished stops its bold career. When we reflect that a transient touch of this rapid flash produces such enduring virtues in a mass of iron—surely it is the pinnacle of nature's works. Yet not altogether so, for man's mind still soars pre-eminent, and, rapid as the wheel might move and the lightning flash, man's mind perceived the effect, and his thoughts and his perceptions were quicker still, or else it would have been a blank.

And is it not surprising that this ethereal essence, which spans the universe in its flight, can be embedded, and lay quiescent in a little needle, and yet retain its powers, and hold direct communication with its parent spirit in the realms above, and own its kindred while

Digitized by Google

yet imprisoned here below? As from the clouds it came, and darted down from heaven, so it retains its sympathy, and is affected by the changes in the loftier regions of the sky. As it was of atmospheric origin, so it has an atmospheric action, and the magnetic needle, in addition to its other invaluable qualities, becomes a highly useful and important instrument of meteorology.

The magnetic needle is influenced and affected principally by the changes in the upper regions of the atmosphere, as seems to be clearly shown by the action of the aurora. Volta discovered that when water is rapidly converted into vapour, it leaves the vessel negative, and the ascending vapour is positive. And it is probable that the circulation of this vapour through the air is connected with its electric states.

The vapour at the cloud line of condensation undergoes a change in respect to its constituent heat and electricity; both are to a slight degree evolved and set free, and a quantity of electricity is liberated, and the clouds, like fogs, become charged with free electricity.

As the vapour took it up, so rain may conduct it down again; hence, the popular idea of heavy rains in the thunder storms rendering them less dangerous.

Electric changes are in every situation most frequent when the causes of evaporation and condensation suddenly succeed each other. Where, then, are these in greater action than at and about the cloud regions? and there is the seat of great and continuous action. Electricity loves water in any form, and the clouds are its residence

Digitized by Google

—hence, the electric condition or state of the upper regions influences the magnetic needle, from the vast expanse and volume of electricity which is there.

What, then, does the magnetic needle teach us, but that the most wonderful and surprising order and regularity pervades the upper regions, and probably the whole superincumbent mass of the atmosphere? For whether the electricity is regarded as acting of itself as a free agent and unfettered by matter, or whether it is acted on by changes in the atmosphere, and follows their conditions, is unimportant to the point in question.

We cannot but be struck with the extreme regularity of the motions of the declination magnet, and its strict adherence to time; hence indicating and demonstrating the prevalence of rigid order, throughout the loftiest regions of the atmosphere of which we have any cognizance. And that, although electricity is the most subtle and active spirit, which would seem almost to pass the limits of time and space, yet, contrary to all this, it becomes the most docile and obedient to order of any. It is quite equal in the exactitude of its motions to the horary oscillations of the barometer in the tropics. If the barometer is influenced by the denser mass of the atmosphere below, the magnetic needle takes up the office where the barometric indication stops, and it tells of the same pervading order and time in the loftier regions. Both tell the same tale, both give the evidence to the same effect, that order is heaven's great law.

Digitized by Google

ABSTRACT OF THE RESULTS OF THE MAGNETICAL OBSERVATIONS AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1843.

Extreme Positions of the Declination Magnet in each Month, or Day and Hour when the marked end of the Magnet was most drawn towards the West and towards the East. (*Table 5, page 4*).

DAY.	MONTH.	EXTREME EAST AND WEST.	ANALYSIS.
D. H. M.		° ′ ″	
7 1 50	January	23 25 38 West	January 7 W.
23 12 0	,,	22 59 7 East	February 6 E.
			March 6 E.
24 4 0	February	23 23 3 West	March 7 W.
6 10 0	,,	22 45 59 East	April 6 W.
			May 6 E.
7 4 0	March	23 18 38 West	
6 12 0	,,	22 55 16 East	January 23 E.
			February 24 W.
6 2 0	April	23 23 0 West	
19 6 0	,,	22 35 1 East	July 24 E.
			August 22 E.
26 1 50	May	23 18 17 West	
6 12 0	,,	22 28 29 East	September 26 W.
			October 26 E.
30 1 50	June	23 24 25 West	
2 20 0	,,	22 59 19 East	September 2 E.
			October 5 W.
25 2 0	July	23 27 45 West	November 3 E.
24 10 0	,,	22 44 6 East	
12 2 0	August	23 22 59 West	Total
22 14 0	,,	22 59 27 East	15
26 2 0	September	23 27 39 West	Recurring Periods
2 10 0	,,	23 5 19 East	out of 24 dates
5 0 0	October	23 27 50 West	of the
26 10 0	,,	23 2 2 East	Declination of the
18 1 50	November	23 23 27 West	Magnet.
3 8 0	,,	23 8 42 East	
12 2 0	December	23 24 5 West	
11 8 0	,,	23 4 50 East	

Digitized by Google

Observe the adhesion to the hours of 1—2 of the westerly direction. There is abundant evidence of recurring periods of the magnetic needle, and that it is particularly obedient to order is most beautifully exemplified in its extreme westerly declination so *rigidly* adhering to about two hours after noon. Nothing can be more decisive, apparently influenced by temperature and following in the train of the sun, while in the hours of early morn it turns to greet his coming, and goes as far to the eastward as it can.

THE LEAST WESTERN DECLINATION, OR THE DAY AND HOUR WHEN THE MARKED END OF THE MAGNET WAS MOST DRAWN TOWARDS THE EAST. *(Table 5, page 41).*

1843—MONTH.	D.	H.	DECLINATION MAGNET. °	′	″	REMARKS.
January	23	12	22	59	7	The wind S. by E. at 23d. 20h. for 2 hrs. only without recording pressure. A mere breath of air.
February	a6	10	22	45	59	The N. wind died at 6d. 12h., a calm until at 6d. 18h. E.N.E. and N.E. wind set in and continued to the 13th.
March	a6	12	22	55	16	The S.W. fell calm at 6d. 12h. and a N.E. air sprang up at 6d. 23h.
April	19	20	22	35	1	At 19d. 12h. the N.E. died & S.W. succeeded
May	a6	12	22	28	29	At 6d. 12h. strong Aurora, wind S.W.
June	b2	20	22	59	19	At 2d. a light air S.E., scud and sky threatening.
July	c24	10	22	44	6	The N.W. falling calm, strong light in the N.W. 24d. 14h.
August	c22	14	22	9	27	S.W. changing to S. by. E., S.E. on 23d. 0h.
September	b2	10	23	5	19	N.E. calm.
October	c26	10	23	2	2	Calm, but on the 27th a light air S.S.E.
November	b3	8	23	8	42	3rd, 6th, and 8th, S. by E. a light gentle air.
December	11	8	23	4	50	S.S.E. calm.

Observe the general tendency to the hours of 10—12 of easterly direction. I have selected the extreme easterly position of the magnet of each month as

Digitized by Google

affording the best test of any connection which I supposed might exist between the action of the magnet and the condition of the atmosphere in the eastern area, in order to ascertain whether any visible effect was associated with the magnetic indication. And the selection of the easterly position was made because the Greenwich Reports inform us, year by year, of the rare occurrence of the E. S. E. and S. E. winds, and their insignificant amount. Therefore, as they were the most rare, they were the most significant and important testimony. And the converse is shown in the cases of the extreme westerly variations of the magnetic needle being almost uniformly attended by westerly winds. The direction of the wind from the east or west appears to have some slight secondary effect or action upon the needle. Nor would such be irreconcileable with our previous acquaintance with the relationship existing between the regular periodic actions of the needle, and the conditions or states of the atmosphere.

It is probably true, as Professor Faraday suggests, that the magnetic action resides in the upper regions of the atmosphere in the great mass or body thereof, and which idea is sanctioned by the influence of the aurora upon the needle. It is tolerably certain that the aurora is at some moderate height, and is generally admitted to be above the lower plane of clouds. Not that we have sufficient reason to adopt the calculations of some very eminent and great authorities, who place it far without the assigned bounds or limits of the atmosphere,

Digitized by Google

altitude. The colours so vividly displayed would appear to be almost conclusive that the action and effect, if not the seat or origin thereof, is in the vapour plane of the atmosphere. And that like the rainbow, halos, sunsets, and colours of the clouds, so the vivid hues, tints, and iridescence of the aurora are owing to the presence of vapour, however attenuated it might be.

Assuming, therefore, that the aurora is moderately elevated, and more properly belonging to the upper than to the lower regions, we may suppose then that the wind might have some slight perceptible effect upon the needle; since the wind is the current from the quarter of high pressure, and which is not solely the result of the action of the lower stratum, but the sum of the aggregate pressure of the mass of the atmosphere. Hence, as the barometer indicates the state of the superincumbent mass, and the wind being the result thereof, the needle may be acted upon by the distant area from which the wind proceeds. Thus, an easterly wind acting on the needle, is assumed to be from some change or condition in the eastern area, in the upper or lower plane; just as much as that the distant aurora affects the needle at Greenwich. If the aurora at a moderate height affects the needle, what prevents any electric state or condition, at the same height and over the same extent of area, affecting the needle in a degree likewise?

The well-recorded fact of Recurring Monthly Periods of maximum and minimum states of the magnetic needle, proclaims its varying condition, and allows of

Digitized by Google

the fair induction that electricity is capable of being transferred. The transfer of electricity is analogous to its compeer, heat. The diurnal periods bespeak a gentle transfer, and the maximum in the one place is a consequence of a transfer from some other area, which consequently has a minimum. The one cannot have more unless the other has less, is the fundamental law and recognized principle.

As heat extends over large areas, and its transfer is upon a considerable scale, so likewise is that of electricity. One atmospheric area loses, and another atmospheric area receives the transfer. Professor Faraday, the most celebrated authority on magnetism, says: "The condition of the two hemispheres may be conceived by supposing an annual undulation (transfer?) of the force to and fro between them, during which, though neither the character nor the general disposition of the power be altered, there is in our winter a concentration and increase of intensity in the northern parts, coincident with a diffused and diminished intensity in the south, and in summer the reverse."

The subjoined account of the mean monthly variation of the declination needle, at two places of the same degrees of latitude, but in opposite hemispheres, presents the evidence of the influence of the seasons upon the magnetic needle. How equable and regular in both, although the antipodes of each other. What an amazing uniformity and conformity to order and recurring monthly periods exists throughout the vast aërial ocean!

Digitized by Google

HOBARTON. LAT. 43° SOUTH.		MONTH.	TORONTO. LAT. 43° NORTH.		
′	″		′	″	
Summer 11	66	January	6	51	Winter
11	80	February	6	40	
9	50	March	8	50	
7	26	April	9	52	
4	56	May	10	34	
3	70	June	11	99	
Winter 4	61	July	12	70	Summer
5	89	August	12	68	
8	24	September	9	72	
11	0	October	7	59	
12	05	November	5	75	
Summer 11	81	December	4	47	Winter

That electrical phenomena depend on some infinitely subtle and powerful agency pervading the material world, is, in the present state of natural knowledge, almost certain. That this agency, although differing essentially from any form of matter of which we have the least cognizance, is itself material, is also highly probable and generally admitted; therefore, we have no difficulty of admitting of the transfer of a given quantity of electricity from one area to another, and from one hemisphere to another, any more than that we in our experiments can transfer the electricity from one Leyden jar to another jar, either in part or altogether. And as we cannot accumulate any charge of electricity without taking it from some other part, so, no mass of clouds can be charged with electricity, without receiving it from some other part of the atmosphere. And thus electricity strictly comports itself with its congener and ally, heat. Both have the property of transfer.

Digitized by Google

Electricity is fairly assumed, and almost proved, to be absolutely transferred from one hemisphere to another. The action is positively apparent and real, and can the agent be absent? The material quality, be it ever so refined, is transferred in such a definite amount, that what the one loses the other gains. Such is as obvious as any ledger or mercantile account, or that a balance the most delicate can declare. It is here again weighed by measure. It is true we cannot weigh the light, but we can measure its beams in the rainbow, which Milton calls "the triple-coloured bow." It is very remarkable that there should be such a strict and perfect mathematical and chemical coincidence between the measures assigned to the colours of the rainbow and their associated gases.

The red rays extend	56	in breadth or volume.
The violet rays extend	109	,, ,,

Thus the violet portion of the bow is double the volume, nearly, of the red. The red rays are heating rays, and analogous to the oxygen end or pole of the electric battery. The violet rays are the chemical or actinic rays; they associate or agree with the hydrogen end of the voltaic battery; and the hydrogen gas is the double combining volume of oxygen. Hence a perfect analogy exists between the volumes of the two colours of the bow, and the gases with which those colours are associated in quality, nature, and action. What a perfect concordance reigns throughout nature! The poets have ever taken it

Digitized by Google

for a fairy vision of some gay creature that in the colours of the rainbow live; and Campbell says—

> "When Science from creation's face
> Enchantment's veil withdraws,
> What lovely visions yield their place
> To cold material laws."

Which, however poetically beautiful, is a most unjust rebuke, inasmuch as truth exceeds fiction.

If electricity is proved to be transferred from one hemisphere to another, consequently from one area to another, then we cannot refuse to assign to heat the same range from hemisphere to hemisphere which electricity possesses. Since we have already demonstrated the transfer of heat from area to area to constitute the leading principle of atmospheric action, then the three aërial agents, infinitely more subtle than the air itself, make to themselves wings and fly away to distant realms. Heat, light, and electricity, are the affections of nature, kindred and congenial spirits, children of the sun, and are as the three graces which constitute the life, the charm, and spirit of the whole material world. The summer gains but what the winter loses, by a gentle transfer of all the three, and universal good prevails where order and obedience reign.

The intensity and quantity of atmospheric electricity are very well represented by lightning and the aurora.

The heated tropics present large masses or plates of gigantic clouds, highly charged with electricity, which rushes down in terrific lightning, melting or fusing the

Digitized by Google

metals, and exhibiting the intensity of electric action, similar to the powerful battery of large plates.

But the electro-polar state is widely different; lightning conductors are not needed where lightning is scarcely seen. And in respect to the action of the magnetic needle, there is a curious circumstance stated in the "Transactions of the Royal Society," 1738.

"Captain Middleton noticed that while among the ice in Hudson's Bay his compasses would not work or traverse, except he heated them by the cabin fire, and then they worked very well, so he always kept one by the fire, and replaced it in the binnacle, changing them every half hour."

The electricity of the polar circle is quantity, diffused in the upper portions of the atmosphere, and manifesting itself in a quiet, gentle, and innocuous form of the aurora, playing in an elegant and graceful manner for hours together. The lightning is electricity in a concentrated state, and of great intensity. The aurora is quantity, greatly diffused and of low intensity.

Does each tropic and the pole form a battery, and do they influence each other through the medium of electricity?

During the summer the tropic is incessantly discharging immensity of lightning, and the polar region is quiescent, as far we know of it by the aurora, because the needle does not exhibit the signal of its presence. In the winter the tropic electricity is more quiescent; but the polar exhibitions of the aurora are more frequent and perhaps almost continuous.

Digitized by Google

Does the aurora discharge in an innocuous manner a large amount of electricity which would otherwise take the lightning form?

From whence comes the electricity of the polar regions? The constant afflux of winds from the warmer regions towards the pole, fraught with moisture—these it is that bring a constant supply of vapour with its latent heat and electricity. The vapour is condensed, precipitated, and sets free its latent heat and attached electricity. The heat and electricity mount upward and soar aloft, and constitute the peculiarity of the polar atmosphere. The S.W. winds, whose course we endeavoured to trace, and observe their conversion into N.W. winds, either rush down with impetuosity, or wend their silent way by an upper current towards the south, and thus return again to the place from whence they came. The electricity attached to the vapour, now disentangled, struggles to get back again, and spreads itself out upon the sky, returning by the upper plane to the regions of its birth. Thus the circuit is completed, and the system of its transfer perfected. The S.W. winds carried it on its wings, and the N.W., with its cirrous expansions, transmit the current back. It goes by the lower road, and returns by the higher.

Digitized by Google

CHAPTER X.

Definition of Recurring Monthly Periods.—Recurring Solar Periods.—The Rotation of the Sun.—The frequent Monthly Recurrence of 21st day.—Extent of Recurring Monthly Periods.—Gradual Progression from Change.—Tendency to frequent Recurrence of the same Number—Examples of frequent Recurring Numbers.—Diathesis of the Seasons.—Application of Recurring Monthly Periods.—Mode of Application.—Practical Testimony of fifty successive years.—Simultaneous Action of two Areas.—Monthly Periods involve larger Periods.—Drought in the Days of David.—Drought at the Cape de Verdes.—Drought at Buenos Ayres.—Famine in Egypt.—Drought of three years in Samaria.—Transfer of Heat, the Locomotive Power.—Barometer affected by the Transfer of Heat.—Periodic System of the Atmospheric Actions.—Nature's Divine Truth, a Hymn.—The Seasons call on Man for Adoration.

Digitized by Google

Digitized by Google

CHAPTER X.

By the designation, "Recurring Monthly Periods of Atmospheric Action," it is intended to denote a "mean period of thirty days twelve hours," corresponding very nearly to a solar month, or that space of time in which the sun passes through one sign of the zodiac. There is a variation of two days on either side of the mean, so that we have the following series :—

28—29 . 30 . 31—1 Days of the Month.

and so on throughout. Any state or condition of the atmosphere, recurring in succeeding months, within *two days* of the same time of each other, is included in, and constitutes, a recurring monthly period.

For convenience and propriety, the specific points of highest and lowest state are taken for standard reference and exemplification, and not that they are the only recurring points or conditions. The mean period was deduced from the "Greenwich Observations," in which alone

Digitized by Google

given in the comprehensive and useful abstracts. It was not a fanciful conjecture in taking this period, which so remarkably accords with the assigned solar month. And when I so uniformly and constantly found the recurring monthly periods to be the same in all the tables of fifty years, and all places from which I could obtain tables, the evidence appeared irresistible.

And in considering the subject, the more deeply I entered into it the more I was convinced that the sun held the controlling power, through the all-pervading agency of heat. But still the question pressed upon me as to what produced the recurring period of about thirty days. The moon, of course, was a candidate, supported by almost universal suffrage, but science does not own that principle, nor owe to it her support. That is not its tribunal nor its court.

And what pretensions has the sun to recurring monthly periods? Assuredly, it has some. Let us take the initial point of astronomy, the vernal equinox of the 21st of March, when spring comes in rejoicing, and then passes on to the smiles of summer, which begins when the sun reaches its highest northern declination on the 21st of June, the summer solstice. Then again descending, comes the 22nd September, the autumnal equinox; and then at last it creeps down to the winter solstice on the 21st December, and thence ascending completes the circuit of his golden reign on the 21st of March.

There is some appearance here of recurring states, and great precision as to days—21st. And certainly

Digitized by Google

these four quarters of the year which the sun metes out to us, are equal to four quarters of the moon. Nor are we without some portion of popular support and even scientific, for Kirwan and others have supposed that the direction of the wind, and the nature of the weather, when the sun crosses the line, as sailors say, has material influence upon the ensuing season.

The four seasons evidently display a recurring trimonthly period of corresponding dates. There would seem to be some monthly tendency in the aggregate. And I presume to suggest as an ideal thought, or shadowy conjecture, that the sun's position in declination is the primary cause of all the actions of the atmosphere, modified in a slight and secondary degree by the different phase, if it may be so called, of his golden image. The synodical rotation of the sun on his axis is given by astronomers as twenty-seven days seven hours, in which time the same surface of sun is presented to the earth.

The sun attains, as we have seen, a *positive* position on certain recurring dates (21st) of the months, but as on each such recurring periods in the succeeding years he does not present the same identical surface, it may not possibly produce the same *exact* effect in all particulars. We therefore have a fixed and permanently recurring period in the declination, but a slightly varying action from the different aspect of the sun.

Nor need the opponents too hastily condemn such a conjecture, since so much importance is universally

Digitized by Google

attached to the moon's face, which, strange enough to say, is always the same, at any rate, she always presents the same aspect to the earth, and if an hour or two difference in the time of her change can produce such immense effects as are attributed to her, I may be excused putting the sun in nomination; although he may not obtain the *absolute* majority of votes, I am satisfied he is qualified for the office, and will fulfil the duties thereof to the satisfaction of all parties.

I may add to the testimonial I have given the following. Taking the 21st June as a most important point, we have the sun occupying precisely the same position on either side, as on 21st May and on 21st July, the sun's declension then being the same, but with a differing aspect. The same occurs in respect to 21st of December, for the 21st November and 21st January the sun has again the same declination. Hence, we have a return of the sun to the same absolute position on recurring monthly dates, as 21st May and 21st July, in addition to the four great cardinal points which determine the seasons. Such are the attributes of the sun.

The recurring monthly periods certainly imply something more than a day, and we cannot for a moment suppose, if any approach to a periodic law obtains for one day, that it ceases for all the rest—in fact, that it is abrogated and set aside. Such cannot be the case, and if the recurring monthly periods accurately denote the days of highest and lowest conditions, surely they are not limited to a day, otherwise

Digitized by Google

their use would be very trivial and unimportant. They have a more extended action and a greater range. Of course it is evident that the extreme points of the highest and lowest are not usually attained all at once; there is some little indication; some progress generally; thus a day or two before the maximum there would probably be an increase, and from the maximum a gradual decrease of a day or two; thence the mere fixing or anticipating the recurring period gives us some extended view of the weather, and we may, by attention, perceive the coming crisis by the daily gentle accessions. The anticipation, therefore, is not so entirely limited as to be useless, but has a more extended bearing than at first might be imagined.

But neither is this all, for the opinion cannot rationally be entertained of such a partial application. If one day or period of days is subjected to a law, the whole is subjected to the same. And it is to this general extension we are to direct our inquiry. If the maximum day in the month exhibits the reverse condition to the preceding, some other days exhibit the reverse condition to their complimentary days. There is not one reverse day only, but several; not one accordant day, but several accordant days, the result of a pervading harmonious principle.

If it is correctly assumed that the recurring monthly periods imply the presence of a law, then all the days of the month will be reduced to the same category.

The recurring monthly periods are only a step in advance, they are not perfect by any means.

Digitized by Google

The first imperfection is the frequent appearance of the reverse state or condition of the recurring period, so that there is a difficulty in knowing what will be the nature of the weather. More extensive inquiry will probably diminish this; at present I must leave it as a stumbling block.

The second is the break or change of period.

Although the barometer or thermometer, individually, may not continue to exhibit the recurring monthly periods, but break off abruptly as if the law had ceased, or was interrupted; yet it will be seen by reference to page 29 that every month in the year 1814 had recurring periods, both of the barometer and thermometer; no month but what appears in the analysis. The continuity is not complete, although it is partially interrupted in some of the periods; but every month is represented in the recurring periods of that year. At page 115 the year 1826 gives nearly the same results, one month, December, missing in the barometer, and May in the thermometer; but May and December appearing with the other instrument.

At page 59 Melville Island displays the same fact; every month appearing to have one recurring period, and some two recurring periods.

Although the recurring monthly periods are subject to a break, there is a tendency oftentimes to a recurring number at intervals. In the epitome of 1814, at p. 28, in the days of the thermometric column, we find the following dates, beginning with November: 29, 29, 30, 30, 28, 28, and ending with August 28, being twice

Digitized by Google

approximate dates, or one-fourth of the whole series, and which is very far beyond the proportion. In the barometric column of the same year, we perceive, November 4, 3, 1, 2, 1, 3, a series of approximate dates, although not continuous.

In our epitome of 1845, at p. 138, we find from the "Greenwich Observations," in the barometrical column of the year, January 19, 21, 22, 21, 19, 18, 22, 19, 19, to December, being nine approximate numbers out of twenty-four entries of the days of the months.

These examples, and of which kind there are many, show a tendency to run upon, or around, certain numbers as a nucleus. And when they are laid down on a delineation, they strike the eye as a cluster, or group, and would seem almost to imply the presence of some principle of attraction or order. There is scarcely a year without more or less of these recurring numbers, and although the continuity is broken, yet there is a propensity to reappear.

As indirect testimony, I adduce the somewhat remarkable absence in the thermometrical tables of each month of any recurring number of the degrees. And as in some months the extreme range of temperature is about thirty degrees, the same quantity of recurring numbers might be expected among them as among the thirty days of the month which constitute our recurring periods. But, as above, we perceive a nucleus, around which a little group cluster; but in the same quantity, viz., 30, in the table of the thermometer, there is no recurrence

Digitized by Google

month, there is only one 19° in the thirty days. Therefore, I presume the frequent recurrence of the nineteenth day is not a fortuitous concourse of atoms, but the result of a periodic law.

It would be unnecessary to run through all the epitomes; they must be left for the personal investigation of those who desire to test their accuracy. The following may suffice to show the extent of the recurring monthly periods (from "Greenwich Observations"):—

1844.
21st November, highest barometer.
21st December, ,,
1845.
21st January, ,,
22nd February, lowest barometer.
21st March, highest ,,

The thermometer of the same period exhibits the following (from "Greenwich Observations," p. 138):—

1844.
27th November, coldest, 23°.
27th December, warm period began.
1845.
27th January, the cold set in again with severity.
27th February, the highest temperature—warmest.
27th March, ,, ,,
24th April, ,, ,,
27th May ,,
28th June, the lowest temperature.
29th July ,,
31st August, the highest temperature.

Surely this long succession is not a casualty. The evidence is perfectly conclusive as to recurring monthly

Digitized by Google

periods, to approximate states, and to recurring numbers.

But the use of instruments is not necessary for our perception of recurring monthly periods in the weather, for a little observation may detect them. For this purpose I drew up the following communication, in order to excite attention to them.

There appears to be often a peculiar diathesis of the seasons, or some prevailing peculiarity which continues for a time; thus, one season may be particularly dry, or very wet, with paroxysms or fits of exacerbation; and in this respect there evidently seems to be a tendency to periodicity or recurring monthly periods of the weather. There are frequently two recurring periods in the month of opposite tendencies, a kind of crisis or critical days, peculiar to, or observable in that diathesis. Not that the same effect always ensues, but that an evident, marked, and sensible crisis takes place, as medical men observe, or are stated to have observed, in some fevers, etc.

Thus, if on the 26th of any month a violent gale or perturbation takes place, then about the 26th of the ensuing months, as long as that diathesis continues, a perturbation will be observed.

1852.

November 26. Gale, S.W.

December 26. S.W. Gale, violent, over the greater part of the kingdom.

1853.

January 26.

February 26. Hurricane Gale, N.W. 12 to 15 lbs. pressure.

Inundations. Earthquakes.

Digitized by Google

March	26.	Great change to very cold weather.
April	26.	Heavy fall of snow and floods.
May	26.	Extremely hot, the hottest day.
June	26.	
July	26—27.	Extremely heavy rain. Lightning flash, storm.
August	26.	S. W. gale. Hurricane at Bristol, and Thebes destroyed by an earthquake.
Sept.	25—26.	Heavy gale and rain, S.W.
Oct.	26—27.	Crisis day, very warm, summer day, heavy rain, lightning and thunder storm.
Nov.	26.	Steady, heavy, and soaking rain. S.E.

This series evidently exhibits from common observation a recurring monthly crisis, and likewise a striking exemplification of the tendency to run upon a given number, or a rigid adherence to order.

Now comes the all-important question—of what use are those recurring monthly periods, or of what advantage? From the past, they lead us to judge, to a limited extent, of the future, as to when we may expect a crisis or a change; and in some degree an anticipation of the nature of the weather at or about that period. They do not warrant us to assume more than a month in advance. The state of the two or three preceding months will enable us to judge with a tolerable degree of correctness of the month in advance.

It may be the commencement or termination of a series; as may be determined by the previous conditions. But as we have four definite or cardinal points in every month, they scarcely ever all fail. Two or more may be expected to afford rational grounds of anticipation. And a little study will lead to an acquaintance with the

Digitized by Google

general principles of the recurring monthly periods, and afford a large amount of practical knowledge respecting the weather, and a correct idea frequently, of what nature the crisis will be. A reference to the examples given in the epitome will be the best elucidation, bearing in mind the extent and limitation of the recurring periods to two days on either side. Thus, if the coldest or hottest day of the current month is on the 3rd, then we are to expect from the 1st to the 5th of the next month to be the hottest or coldest likewise. The same rule applies to the highest and lowest barometer, which, if in the current month it is on the 14th, then from 12th to 16th of the ensuing month we may expect the highest or lowest barometer again, and their appropriate and accompanying winds, and the usual attendant weather upon such states of the instruments and wind.

Even such a degree of anticipation as is thus afforded may be acceptable in some instances; and in agricultural pursuits, especially in the more important months, from June to October, a little forewarning may be useful—some rational expectation be serviceable. Imperfect and incomplete as the recurring monthly periods may be, they are capable of much improvement, and if studied and investigated, even in their present state, will often give surprising and wonderful results.

They have yielded me often much delight in the successful anticipation of the result, and during the sojourn of our army in the Crimea, from whom reports of the weather were constantly received, I watched with

Digitized by Google

the deepest interest the recurring monthly periods. There was a sympathetic action in the atmosphere between the two places, as quick, as sensitive, and delicate as ever prevailed in the tenderest bosoms, or glowed in the hearts of an anxious people.

I think it is competent, upon the fair principles of experience, to deduce some practical results and advantages from the recurring monthly periods, and from the recurring approximations, and the frequency of a recurring number, throughout the year. They are no random conjectures, but positive inferences from preceding occurrences, and based upon the testimony and experience of the best and most competent authorities, of fifty successive years. They are a general law, with special clauses, and they are of universal and easy application.

Having demonstrated the existence of recurring monthly periods in our own climate, it only remains to state, that they prevail likewise in other countries, and it becomes a matter of interesting research to know our corresponding areas. One place answers to another within certain limits, and I can only provisionally assign the atmospheric areas with which London holds a direct and influential communication to be—on the

N.W. with Iceland, Greenland, etc.
W. with Newfoundland, Canada, the United States.
S.W. with the tepid waters of the Atlantic Ocean, Madeira, and the parallel of 32° latitude.
N.E. with St. Petersburg, Siberia, etc.
E. with the continent of Europe in our own parallel.
S.E. with Jerusalem, Bagdad, Egypt, and the Mediterranean.

Digitized by Google

I have unquestionable and undoubted testimony, more or less, from all these, which confirm and establish an intercommunication and corresponding action with each other. I cannot pretend to assign the exact limits from the fragments I have gathered, but they are positive facts and approximations. And it must be borne in mind that it is not possible for any single, isolated effect to take place. The electric telegraph requires two stations, a transmitting and a receiving office, however near, or far apart. And the same condition strictly and precisely exists in the atmosphere; two stations or areas must act together; a transmitting and a receiving area, however distant or near. Nothing does take place in the atmosphere, except under this express condition, this universal and essential principle. We correspond then, with distant regions, other areas, and we can experience no change whatever, however small or great, without some corresponding change in other parts. The telegraph requires a return current to complete the circuit. The atmosphere requires a reciprocating action to maintain the balance of its powers—a returning current to restore the equilibrium, and sustain its motions.

There are intervening points or stations on the line of communication between us and Iceland, so that the message or the action may not be transmitted from Iceland, but merely on that line. The same in respect to Madeira, the communication may be between us and Madeira, but it may be only half-way or less on that line.

Digitized by Google

correspond with Madeira itself, although the action itself may proceed from some point on that line, or direction, or within some part of that area.

A telegraphic message may be transmitted from London to Chelmsford on the Eastern Line, but it may likewise be transmitted further down on the same line to Ipswich. The same condition exactly holds in respect to atmospheric action; there is no absolute or definite local point, the sole residence of action. The word Madeira area or S.W. line, must be taken in a general sense, and as embracing a considerable extent.

Although we have not arrived at the fact, yet it is difficult to resist the conclusion that these smaller recurring periods are but a part of some greater. That there is a recurring period of years, seems evident on the face of the thing. There has long been a supposition of a cycle of eighteen or nineteen years, in connection with the moon. It is necessary to have the minor periods established, before the difficulty is increased by the investigation of the larger.

There is one most impressive and solemn fact recorded both in sacred and secular history, and having the testimony of 2,762 years, in respect to "droughts." From the famine in Samaria, 966 years before the Christian era, to the most distressing famine at the Cape de Verdes in 1856, A.D., there is one uniform characteristic, viz., a period of three years' duration. That which obeys a period in the one respect may do so in other points. And it is probable that these great afflictive droughts have recurring periods. The vast

Digitized by Google

and melancholy importance of the subject is almost overwhelming, they are among the most terrific visitations, the most fearful and the most appalling. Their endurance of three years is a most awful feature; such prolonged misery sweeps off myriads of our race. The evidence we have to adduce is conclusive to one point only, viz.—the period of three years; all the rest, except the tale of woe, misery, and death, is wanting. A spirit of inquiry may do something, and surely the practical bearings of meteorology are inferior only to those of astronomy.

In the 21st chapter of the 2nd book of Samuel, it is narrated—"There was a famine in the days of David, three years, year after year, and David inquired of the Lord." And from the time of David unto the present there have been recurring droughts of three years' duration throughout the Holy Land, and producing great distress and suffering at Jerusalem lately.

Mr. Barrow (afterwards Sir John Barrow,) in the account of the Cape de Verde Islands, says of 1793—"In fact, a drought of three years' continuance, and consequent famine for almost the same period, had nearly desolated the island."

It is somewhat remarkable to find the following pathetic appeal in "The Times," May, 1856.

"*Great Destitution in Cape Verde.*—A letter from the Cape Verde Islands says, the people of these islands, particularly of St. Antonio, are at present in the very depths of misery, dying literally by hundreds from starvation, and it is anticipated, by well informed people,

Digitized by Google

that at least one half of the population, which at present is 30,000, will perish. Philanthropists may find ample scope for their generosity, but it must be prompt, as the case of the inhabitants is now all but hopeless, and a little relief might save thousands of poor wretches from a miserable death. Or better, perhaps, than anything else would be the giving them the chance to leave the islands, from which the favor of the Almighty appears to have been removed, there having been *no rain for three years.*"

The " gran seco" or great drought at Buenos Ayres, etc., was in the three years 1827, 1828, 1829.

In the Voyage of the Beagle, by Captain Robert Fitzroy, we find the following account given by Mr. Charles Darwin, the naturalist :—

" For three years so little rain fell, that vegetation, even to the thistles, failed. The brooks were dried up, and the whole country assumed the appearance of a dry road. Very great numbers of birds, wild animals, cattle, and horses perished for want of food and water. The deer came to drink at the wells in the court yards of the houses, and the partridges scarcely had strength to fly away. At the lowest estimate, the loss of cattle in the province of Buenos Ayres alone was upwards of one million head. Herds of cattle rushed into the Parana, and being exhausted by hunger, they were unable to crawl up the banks, and thus were drowned. Several hundred thousands of animals thus perished in the river. Their putrid bodies floated down the stream, and all the small rivers became highly saline, and caused the death

Digitized by Google

of a vast number of others. The small streams in the Pampas were paved with a breccia of bones. Subsequently to this great drought, a very rainy season commenced, which caused great floods. Hence it is certain that some thousands of these skeletons were buried by the deposits of the very next year. What would be the opinion of geologists, viewing such an enormous collection of bones of all kinds of animals, and of all ages, thus embedded in one thick earthy mass? Would he not attribute it to a flood having swept over the surface of the land, rather than to the common order of things? These droughts to a certain degree seem to be periodical, and the intervals about fifteen years. A tendency to periodical droughts is common to most dry climates."

Such is the graphic description of an eminent naturalist. Australia is subjected to the same visitations; and they may fall with great severity when more thickly peopled. It is one of the drawbacks it has, in common with all the lovely borders of the tropics.

These periods of drought are attended with their counter-action or balance of great rains in other districts, or very wet seasons and prodigious floods.

In the years in which the Nile does not rise to a favourable height, dearth and famine prevail in Egypt. The streets and public places swarm with meagre and with dying skeletons, whose faltering and sepulchral voices implore in vain the pity of passengers, the common danger having hardened every heart. The famine in Egypt is thus described by Mr. Hope, in "Anastatius."

"Already the consequence of scarcity began to

Digitized by Google

appear in many places and in spite of every expedient of human wisdom. Such was the progressive fury of the scourge, that at last the Schaiahs, and other regular ministers of worship, supposing the Deity to have become deaf to their entreaties, no longer presumed to address the offended Majesty of heaven. Henceforth they addressed the Almighty through the interceding voice of children of tender age. Hoping that Providence might still listen to the supplications of untainted childhood, and grant to the prayer of babes what it withheld from the agonizing cry of beings hardened in sin. Led by the Imans to the tops of the highest minarets, little creatures from five to ten years of age, there raised to heaven their suppliant hands and voices, while all the countless myriads of Grand Cairo, collected round the foot of these lofty structures, observed a profound and mournful silence. Their only prayer was to be speedily delivered from their lingering and painful agony by the hand of death. Ever and anon, then, the whole of the vast population below, with feeble and sepulchral voices, and as with one deep sigh, exclaimed, 'So be it;' or when any touching supplication was more particularly made, another sigh burst forth from the assembled multitude, and who with increased emphasis responded, 'God is bountiful.' In the hour of nature's most distressing agony they display the most exemplary patience and the greatest fortitude and resignation. And when sinking even into the arms of death, will scratch a trench in the sand, and enveloping his body in his winding sheet, which he always keeps prepared, lies down to die,

Digitized by Google

and offering up his devout prayers to heaven, covers his body with the sand, and with patient resignation waits till the wind completes his burial."

The exquisite truthfulness and the touching simplicity of the Scripture narrative will form the best and most appropriate and beautiful conclusion to my subject.

"And Elijah the Tishbite, said unto Ahab, As the Lord God of Israel liveth, before whom I stand, there shall not be dew nor rain these years. . . And it came to pass after many days, that the word of the Lord came to Elijah, IN THE THIRD YEAR, saying, Go show thyself unto Ahab; and I will send rain upon the earth. . . . And there was a sore famine in Samaria. . . And Ahab said unto Obadiah, Go into the land, unto all the fountains of water, and unto all brooks; peradventure we may find grass to save the horses and mules alive, that we lose not all the beasts. . . And Elijah went up to the top of Carmel, and cast himself down upon the earth, and put his face between his knees, and said to his servant, Go up now, look toward the sea. And he went up, and looked, and said, There is nothing. And he said, Go again seven times. And it came to pass the seventh time that he said, Behold, there ariseth a little cloud out of the sea, like a man's hand. And he said, Go up, say unto Ahab, Prepare thy chariot, and get thee down, that the rain stop thee not. And it came to pass in the meanwhile, that the heaven was black with clouds and wind, and there was a great rain. And the hand of the Lord was on Elijah; and he girded up his loins, and ran

Digitized by Google

before Ahab to the entrance of Jezreel."—(1 Kings, xvii, xviii.)

Independent even of any practical application, there is a delightful pleasure in the investigation of the phenomena of nature. The pursuit of anything that is conducive to our happiness is among the most useful, as happiness, in some form or other, is the object of all our undertakings. The present inquiry has attempted to embody the following principal points:—

1st. That heat is a locomotive, self-moving, agent, and is transferred from one portion of the atmosphere to another. That in the transfer of heat from A to B, A becomes colder and B warmer, both at one and the same time, or simultaneously; and they may remain in this opposite state an indefinite time; and constituting, in this condition, what I term a polarity of heat; and this takes place over extensive areas at distant points, giving rise to the coldest day in one place, and producing the warmest day in the other; and if prolonged for a longer period, causing a cold season at A and a warm season at B—all being simultaneous and synchronous. This is the prime and essential point.

2nd. It immediately results from the transfer of heat that the colder air at A, in whatever strata it may be, or of whatever extent, becomes denser, heavier, and contracted or diminished in volume by the loss of each degree of heat; while, at the very same moment, the equivalent degree of heat transferred

Digitized by Google

from A, produces at B a rarefied, lighter, and increased volume, proportioned to the accession of each degree of heat received. The increased volume at B supplies the diminished volume at A, consequently the colder area receives absolutely an additional quantity of air, and B loses the same quantity of air; and this is positively denoted and demonstrated by the most accurate instrument we are in possession of.

The barometer being the most exact of all balances exhibits to us the absolute and real weight of the superincumbent column of air, and the barometer shows that a greater weight of air is present at A and less weight at B. They are co-existent, simultaneous, and absolute conditions resulting from the transfer of heat.

3rd. It inevitably follows that the heavier air or greater weight at A exerts an active force or pressure, and flows down upon and into the lighter area, or smaller weight of air at B, which current or passage of air constitutes the wind. This is a fundamental law.

4th. Heat is the well known agent or power by which vapour or steam is produced, the quantity being proportioned to the degree of heat. Hence, the cold air at A has less power of holding vapour in solution than at B. The dry thermometer in the free air, and the wet bulb thermometer in the same position, disclose to us the rate of evaporation, and the quantity of vapour held in solution or suspension in the air. Hence, we obtain the most elegant and delicate result, called the

Digitized by Google

dew point, one of the most beautiful applications of the thermometer, exemplifying some of the most important actions of the atmosphere, as, not only the little tiny dew drop, but the formation of clouds, rain, and evaporation —all parts of one immediate act. Such are the well known and extensive operations of atmospheric heat.

But electricity is another atmospheric agent of considerable power, possessing very distinct properties, which I have endeavoured to pourtray.

Now heat and electricity, alike in all their actions, states, and conditions, manifest a complete obedience to time and order—daily periods at stated hours, monthly periods, and recurring monthly periods of very peculiar and specific characters, and differing from the usual laws, by exhibiting at recurring periods of time reverse conditions or states.

The strict and uniform accordance with time and order which the thermometer and barometer display, with the winds, the dew point, the vapour, and the rain, and the like scrupulous regularity of the movements of the magnetic needle, as well as the dipping needle, which conform alike to the strictest order, evidently show that a kindred spirit actuates and pervades the bosom of the atmosphere. All claim the same origin, all hold the same alliance, all obey the same order, and have recurring monthly periods. Therefore, from the loftiest summits of the atmosphere, to some unknown depth within the earth, an universal sympathy prevails. The more we soar and the deeper we go, the more obvious it

Digitized by Google

becomes that one power binds, sustains, and rules the whole, and that order is the universal law, and the lovely principle of obedience is the impress of heaven. Thus the whole act in harmony, and all is sublimely great and divinely good.

A HYMN.

"These, as they change, Almighty Father, these
Are but the varied God. The rolling year
Is full of Thee. Forth in the pleasing Spring
Thy beauty walks, Thy tenderness and love.
Wide flush the fields; the softening air is balm;
Echo the mountains round; the forest smiles;
And every sense and every heart is joy.
Then comes Thy glory in the summer months,
With light and heat refulgent. Then Thy sun
Shoots full perfection through the swelling year:
And oft Thy voice in dreadful thunder speaks.
Thy bounty shines in Autumn unconfined,
And spreads a common feast for all that lives.
In Winter, awful Thou! with clouds and storms
Around Thee thrown, tempest o'er tempest rolled.
Majestic darkness! On the whirlwind's wing
Riding sublime. Thou bidd'st the world adore.
Mysterious round! what skill, what force divine,
Deep felt in these appear! A simple train,
Yet so delightful mixed, with such kind art,
Such beauty and beneficence combined.
Shade, unperceived, so softening into shade,
And all so forming an harmonious whole,
That as they still succeed they ravish still.
But wandering oft with brute unconscious gaze,
Man marks not Thee—marks not the mighty hand
That ever busy, wheels the silent spheres;
Works in the secret deep: shoots, steaming, thence,
The fair profusion that o'erspreads the Spring;
Flings from the sun direct the flaming day;

Digitized by Google

And, as on earth, this grateful change revolves,
With transport touches all the springs of life.

Nature attend! join every living soul,
Beneath the spacious temple of the sky;
In adoration join, and ardent raise
One general song! To Him, ye vocal gales,
Breathe soft, whose Spirit in your freshness breathes.
Soft roll your incense, herbs, and fruits, and flowers,
In mingled clouds to Him, whose sun exalts,
Whose breath perfumes you, and whose pencil paints.
Great source of day! best image here below
Of thy Creator! ever pouring wide
From world to world, the vital ocean round,
On nature write, with every beam, his praise.
Ye chief, for whom the whole creation smiles,
At once the head, the heart, the tongue of all,
Crown the great hymn! in swarming cities vast
Still sing the God of seasons as they roll.
For me, when I forget the darling theme,
Whether the blossom blows, the Summer-ray
Russets the plain, inspiring Autumn gleams,
Or Winter rises in the blackening east,
Be my tongue mute, my fancy paint no more,
And dead to joy, forget my heart to beat!
Come then, expressive Silence, muse His praise."

THOMSON.

FINIS.

Digitized by Google

IPSWICH :

PRINTED BY J. M. BURTON AND CO.

Digitized by Google

Digitized by Google

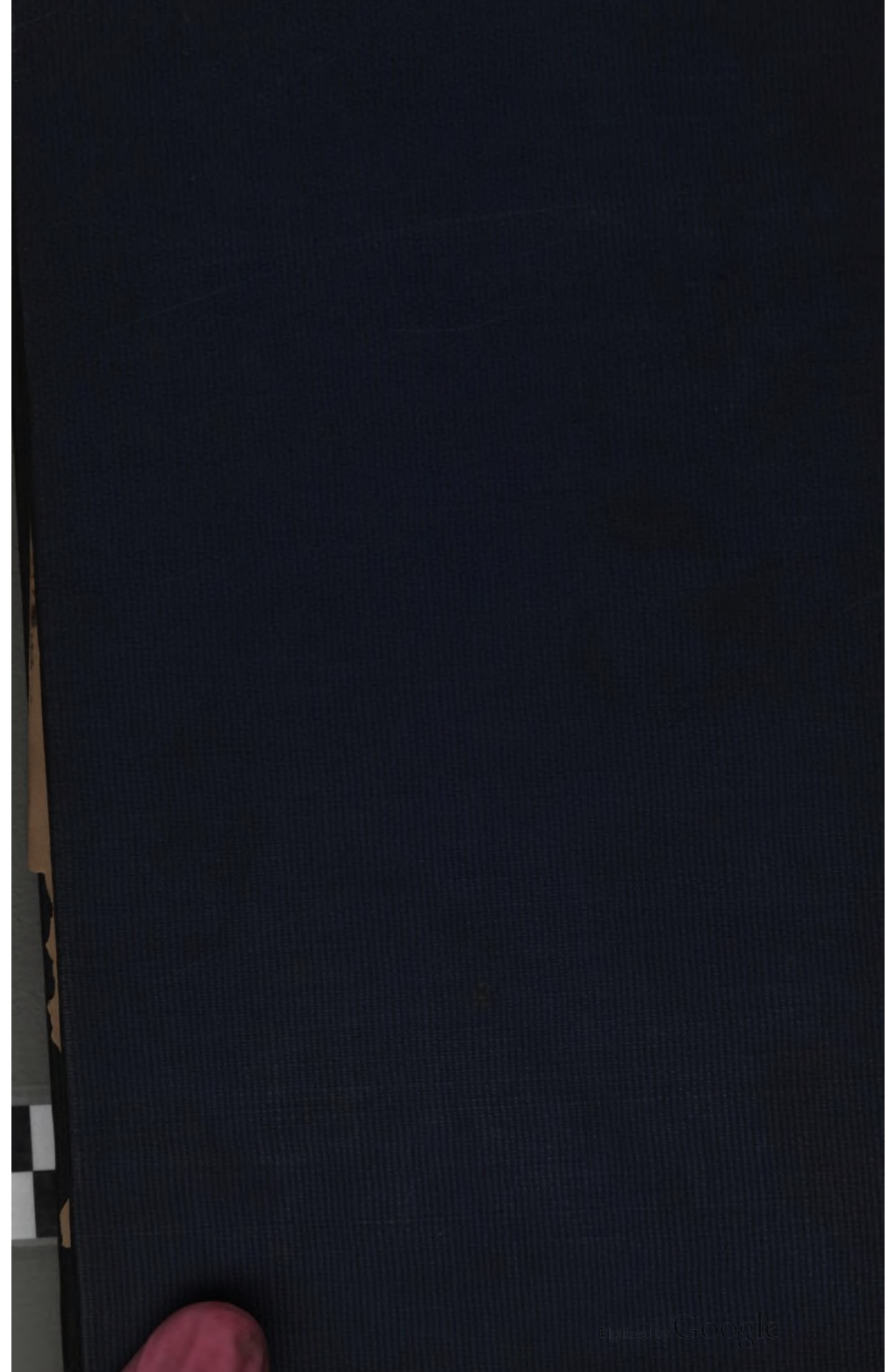
Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google